# plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

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Use of Disodium M-Benzenedisulfonate as a Hardening Agent in a Watts Nickel Bath

Age Hardening of Chemical Nickel Coatings

Electrophoretic Deposition of Metals, Metalloids and Refractory Oxides

The Contribution of Nickel and of Chromium to the Durability of Decorative Plating

10 Questions, 10 Answers Concerning AES's Los Angeles Convention

AES 1960 Annual Convention (Los Angeles) Program

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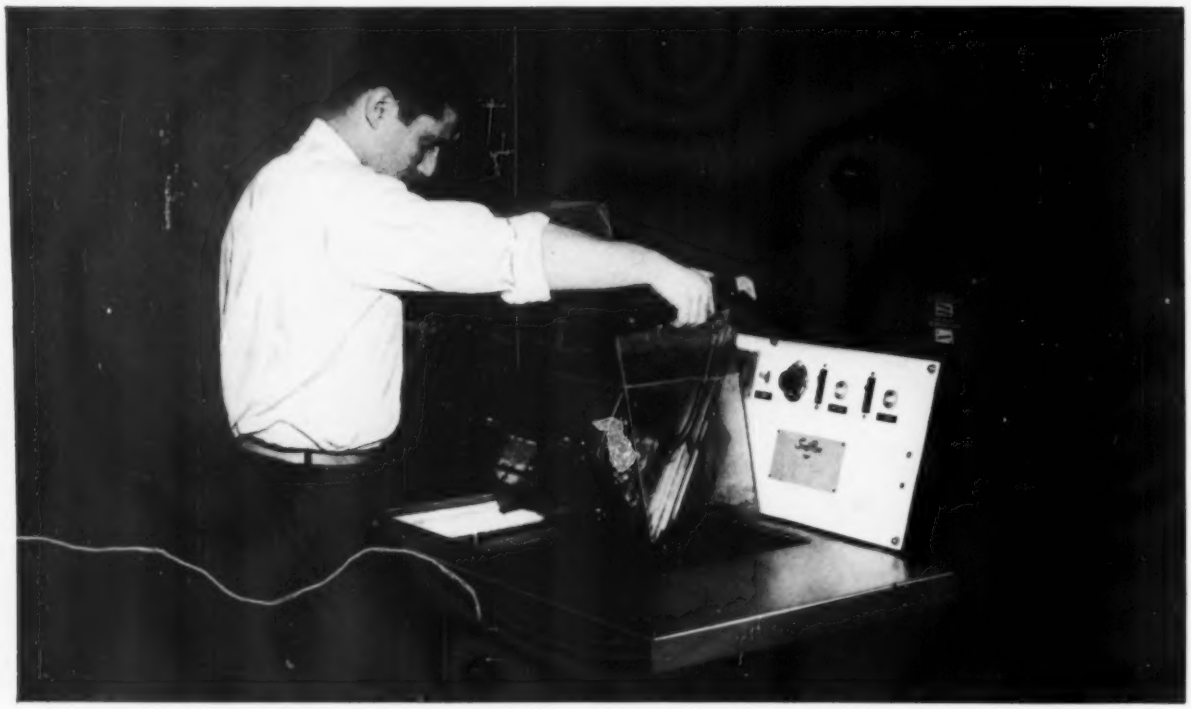
PLATING MAGAZINE

AMERICAN ELECTROPLATERS' SOCIETY

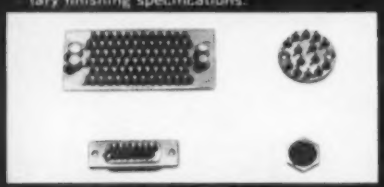
MARCH - 1960



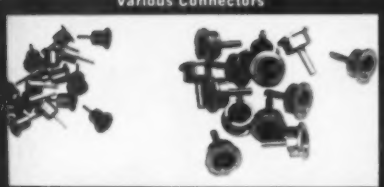
One of 3 Sel-Rex Platers in which Glass-Tite "barrel-plates" over 1-million components a week with Autronex Acid Gold.

# Glass-Tite Industries Improves Transistor-Headers' Reliability with Autronex* Acid Gold Electroplate

In business only 3 years, Glass-Tite is already one of the three top producers of glass-to-metal, hermetically-sealed transistor products in the country. Their products meet or surpass all applicable military finishing specifications.



Various Connectors



Diode Bases

Transistor Bases

These quality Autronex Gold Plated transistor products will be on display at the IRE Show Mar. 21-24, N. Y. Coliseum, Glass-Tite Industries booth #1109.

Wrap transistor-header lead wires around a 40-thousandth mandrel—subject the headers to a scorching 400°C—dip them in a highly concentrated solution of hydrofluoric, nitric and acetic acids (CP-4) and you have some idea of what Autronex Acid Gold Electroplate withstands at Glass-Tite Industries, Inc. Providence, Rhode Island. Actually, all these "tests" are functional. The transistor headers will be subjected to similar conditions by military and industrial end-users while becoming critical comcomponents in complex electronic equipment.

According to Mr. John Newman, Chief Chemical Engineer at Glass-Tite, the Autronex Acid Gold Electroplating Process was installed because it demonstrated dramatic superiority over other materials. On one occasion, Mr. Newman relates, Autronex Gold Plated Transistor-Headers were left in the CP-4 etch solution *overnight*—"... just to see what would happen." By morning, the glass seals had dissolved, the Autronex Gold Electroplate had not been affected.

The famous glass-to-metal, hermetically sealed transistor bases produced by Glass-Tite Industries, end up in multi-million dollar, missiles, rockets, and computers. In applications like these, only the best is good enough. That's why Glass-Tite and leading electronic component manufacturers the world-over specify Autronex Gold Electroplate.

Sel-Rex are the largest selling Precious Metal Electroplating Processes in the world. Free technical literature on request—specify application.

*Trade mark for Sel-Rex patented Acid Gold Plating Process*

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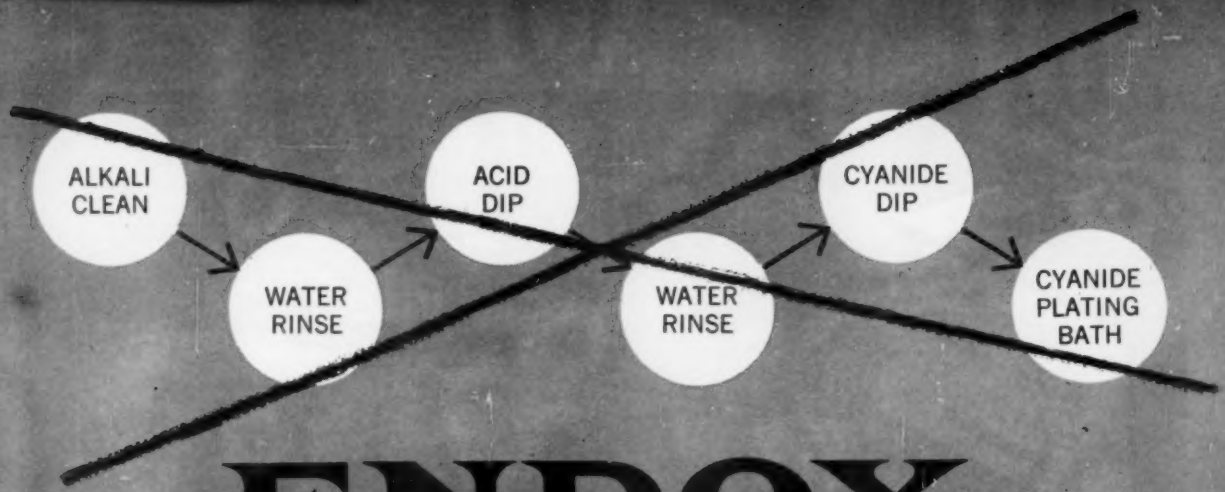


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## *the PATENTED alkaline deoxidizing process prepares steel for plating in one simple step!*

In one, simple electrolytic operation, Endox completely removes rust, scale, smut, soil and oxides from steel and activates it for plating. On work that has been precleaned to remove heavy solid soils, no alkali cleaner, acid dip or cyanide dip are required. Endox replaces them all and gives superior plate adhesion, especially on difficult-to-activate alloy steels. Acid attack and acid fumes are eliminated by use of this room-temperature, alkaline process.

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Endox also produces excellent results prior to acid plating baths. It has solved many problems involving adhesion of nickel plate to malleable iron and alloy steel parts which are later subjected to stress. Prior to acid plating, however, the alkaline Endox residue should be neutralized by a dilute acid dip or "sour rinse".

Endox can be used in both barrel and rack plating lines. Endox solutions are very economical to use because they can be maintained indefinitely by periodic analysis and replenishment, just like a plating bath.

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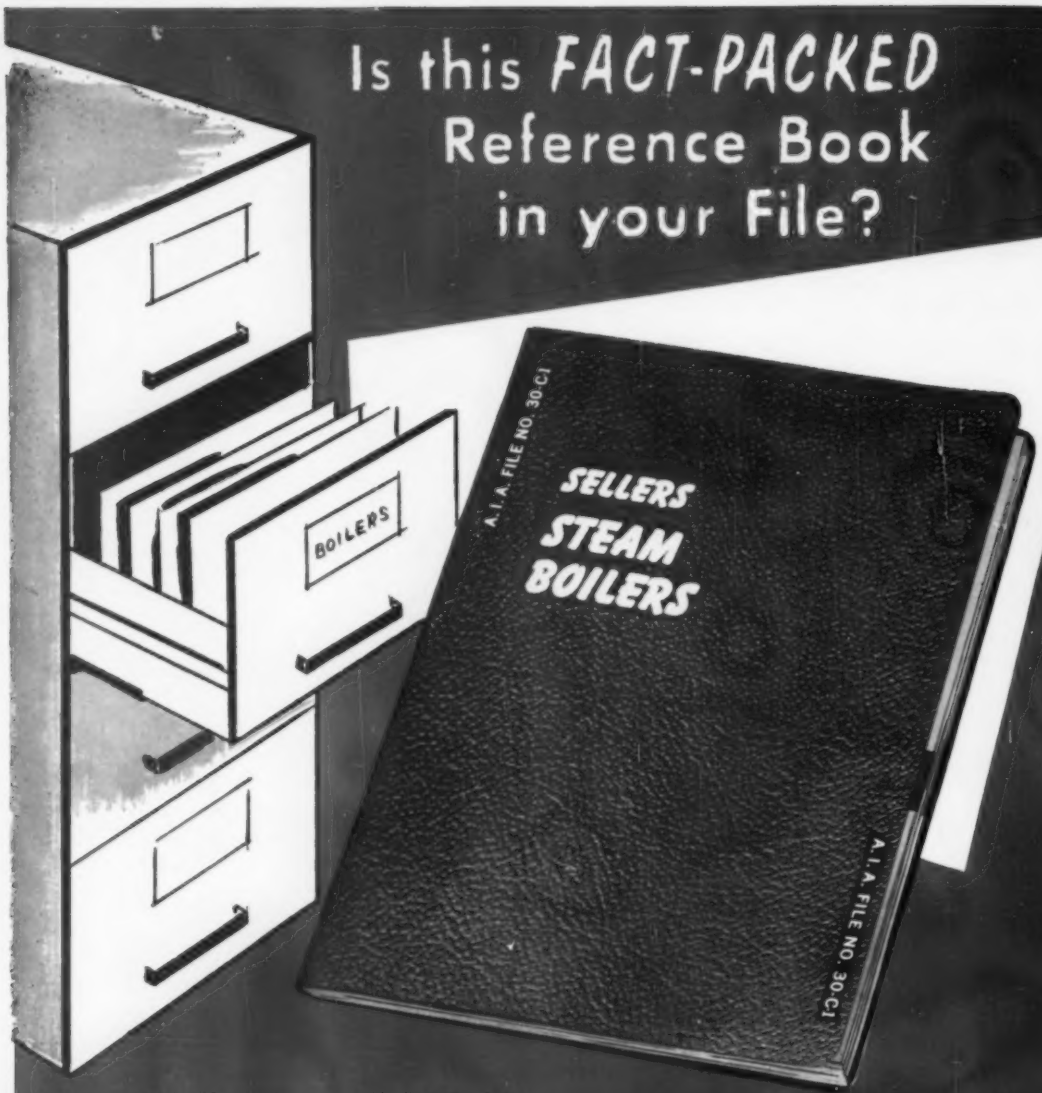


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# plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

**MARCH 1960** **Vol. 47, No. 3**

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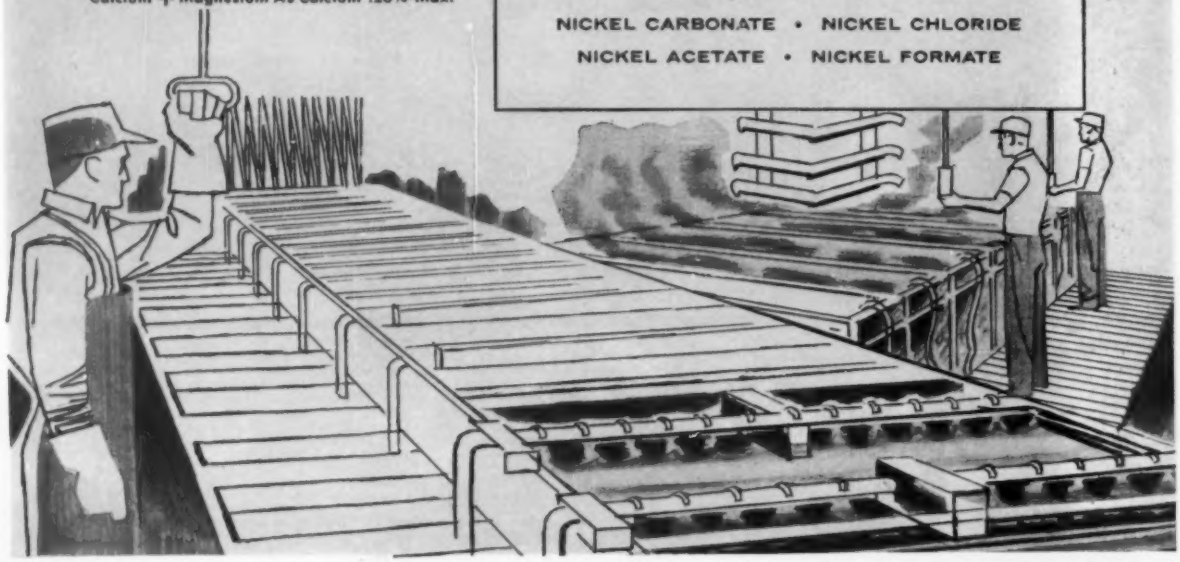

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# EDITORIAL

## WHAT GOOD IS THEORY?

THE MAN SADDLED WITH RESPONSIBILITY for production may not be impressed by the idealistic aspects of research: man's striving to know the truth, the beauty of the workings of nature, the nobility of creative thought. On the contrary, he may mistrust the man in the ivory tower who is trying to learn the mechanism of a practical reaction. He tends to be very conservative when faced with a new theory concerning a familiar process. When he does so, he forgets that a good theory, even if it is incomplete, can be a very valuable and practical tool.

Someone has said that a picture is worth a thousand words. In the same way a theory can be worth a thousand tables of data laboriously gathered, bit by bit. A good theory must condense within itself, all or almost all, the facts thus far known about the reaction or process concerned. Let us cite a theory which anyone can understand and which is applicable in all fields of science and engineering. The principle of LeChatelier states that if any system in equilibrium is subjected to a change, the equilibrium will shift in such a direction as to tend to annul the effect of that change. Thus, if one knows simply that water is heavier than ice, he can predict that an increase in pressure will not make a mixture of water and ice freeze but will cause the ice to melt, thus making the total volume smaller and tending to relieve the pressure.

Another valuable feature of a good theory is that it can suggest ways in which to improve a product or make a process more efficient. The man in the plant can often use LeChatelier's principle to tell him whether to raise or lower the temperature or pressure or *p*H to obtain a better yield of the product he is making.

In our own industry, there is need to discover the theory of many practical operations even though data have been accumulated on them for many years. Progress may continue to be slow until an understanding of what is actually happening is obtained. Recognizing this need, the AES supports a search for theory in the projects administered by its Research Committee. How little we still understand of the nature of porosity in electrodeposits, the influence of the basis metal on the durability of the metallic or organic coating applied to it, the ancient art of cleaning metals or the mechanism of electrodeposition itself! Let us speak always in favor of research, if not for idealistic reasons, then at least because the practical rewards can be so valuable.

It should not be amiss for us to point out that another and newer activity of the AES should lead to promulgation of useful theories. This is the establishment of the Scientific Achievement Award. The award winners of the future, in preparing their William Blum Lectures, will have a tremendous incentive to clarify the theory of that part of the science of metal finishing in which they are expert.

Over the years everyone in our industry, at whatever level or in whatever branch, is going to benefit from these activities. To answer the title question: theory can be of much good indeed.

*W. A. Wesley*

*First Vice President*
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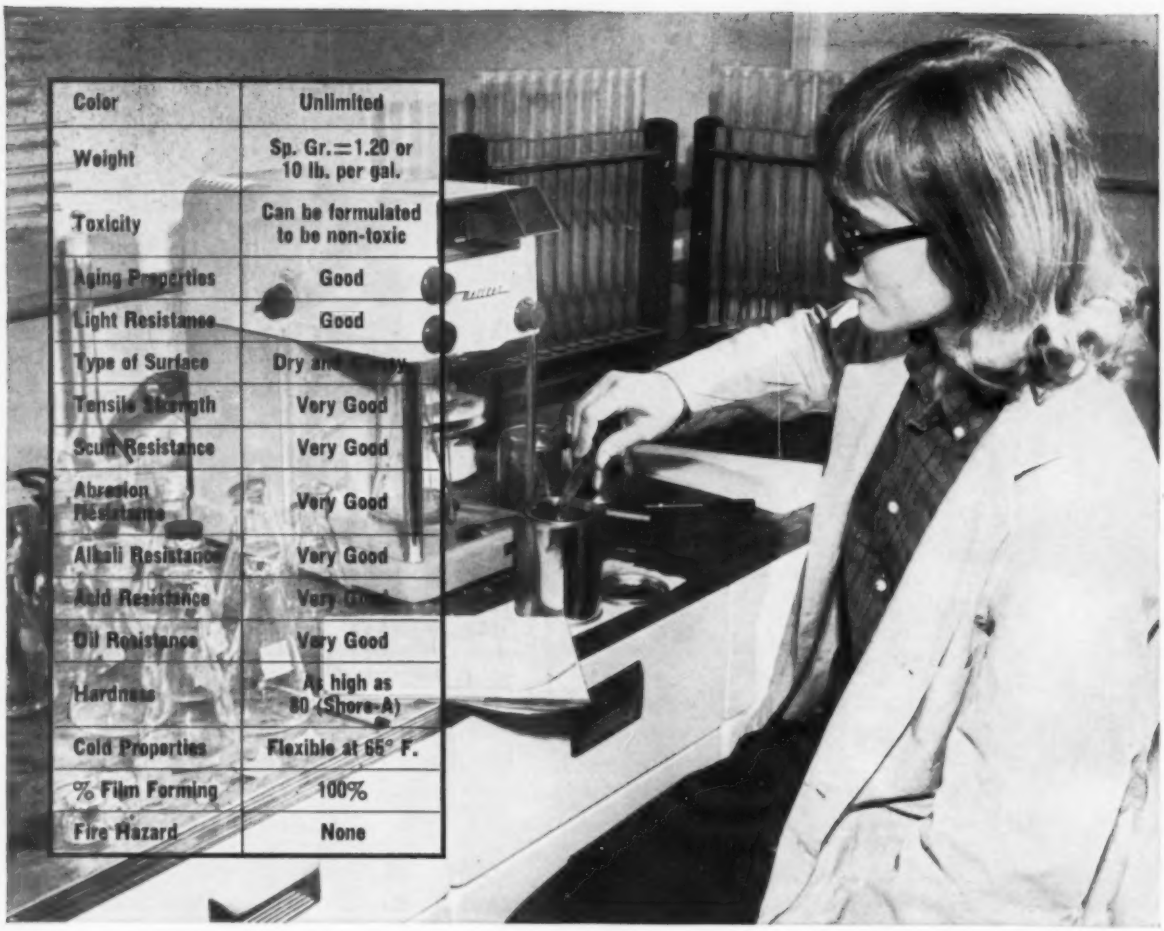

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| Alkali Resistance | Very Good |
| Acid Resistance | Very [illegible] |
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## by Ben P. Sax

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Sincerely,

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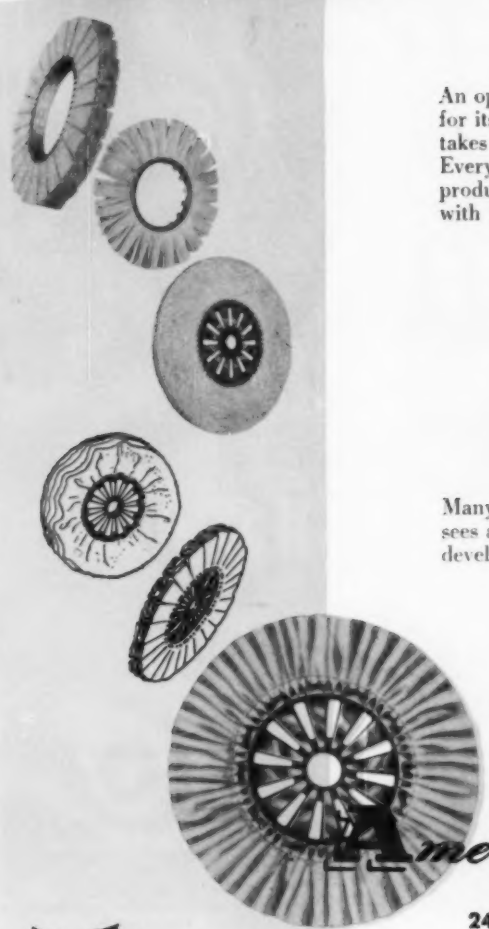

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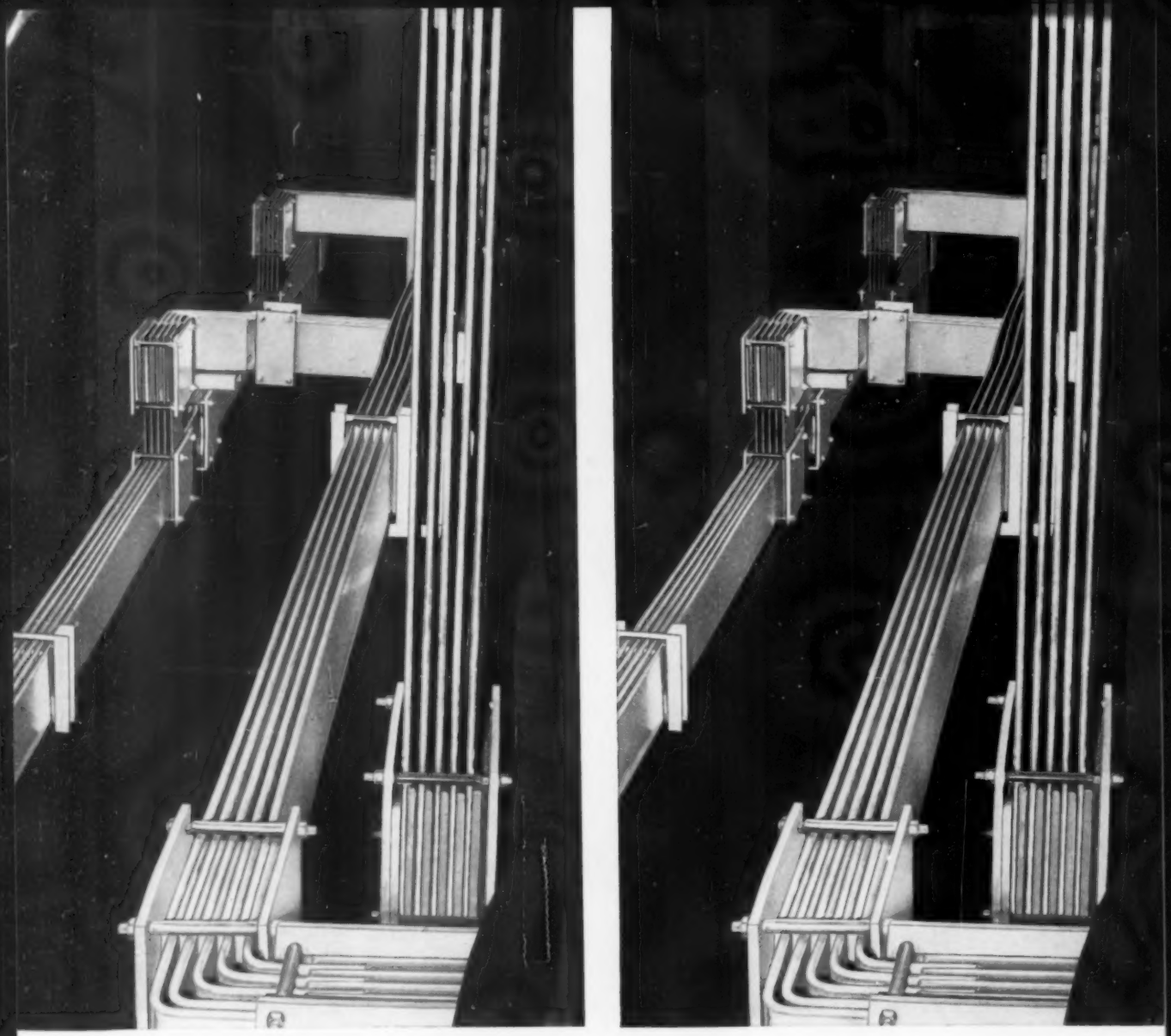

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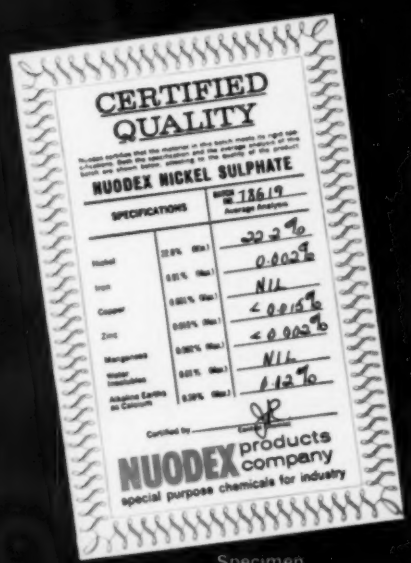


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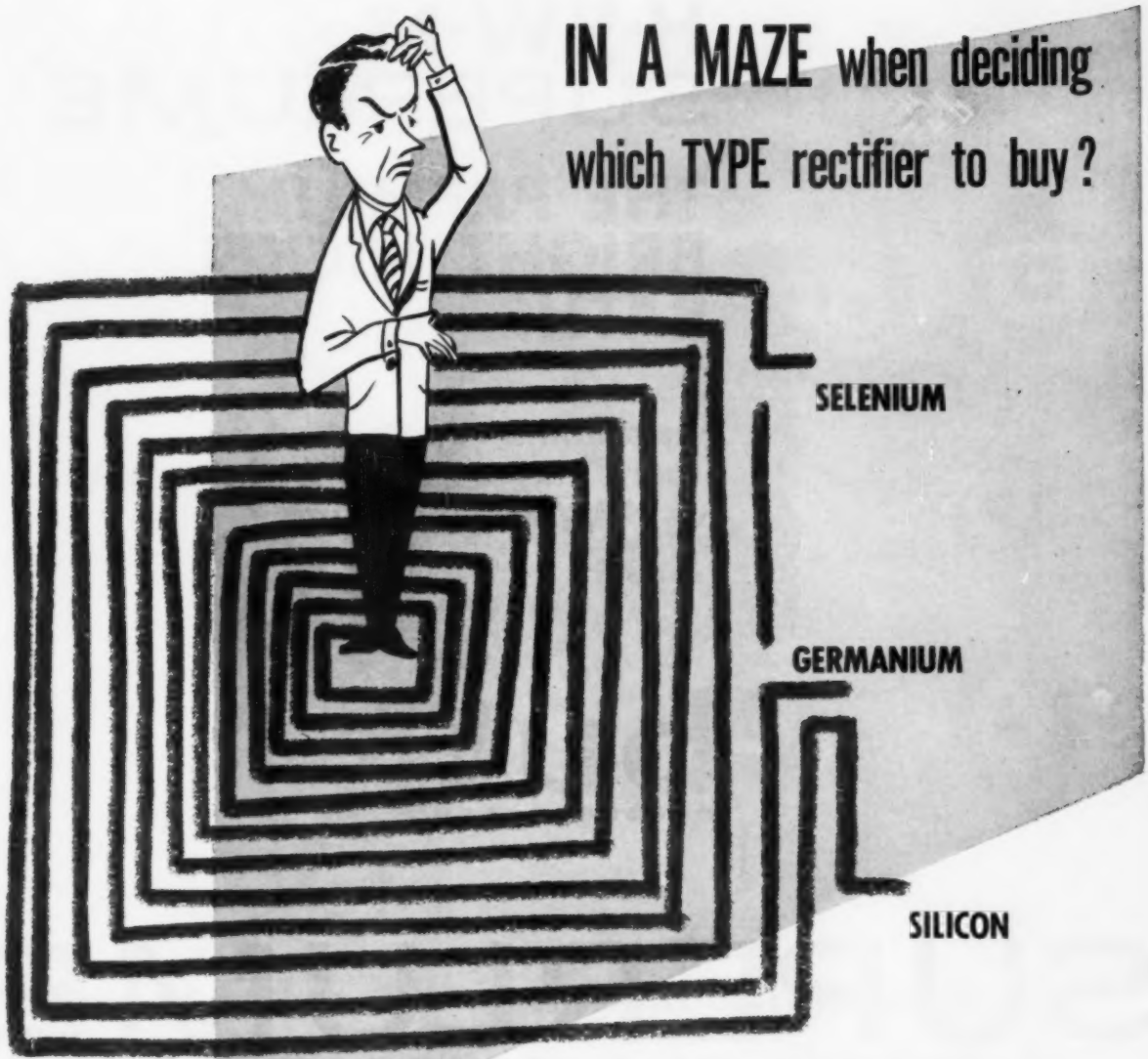


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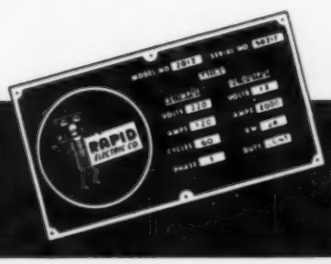


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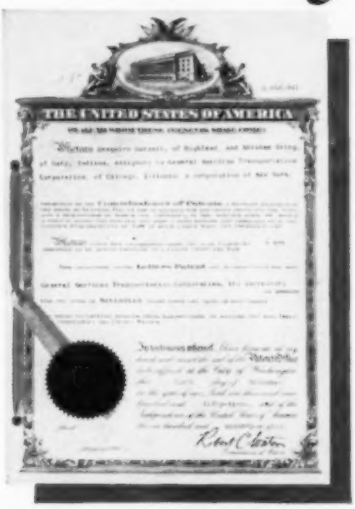


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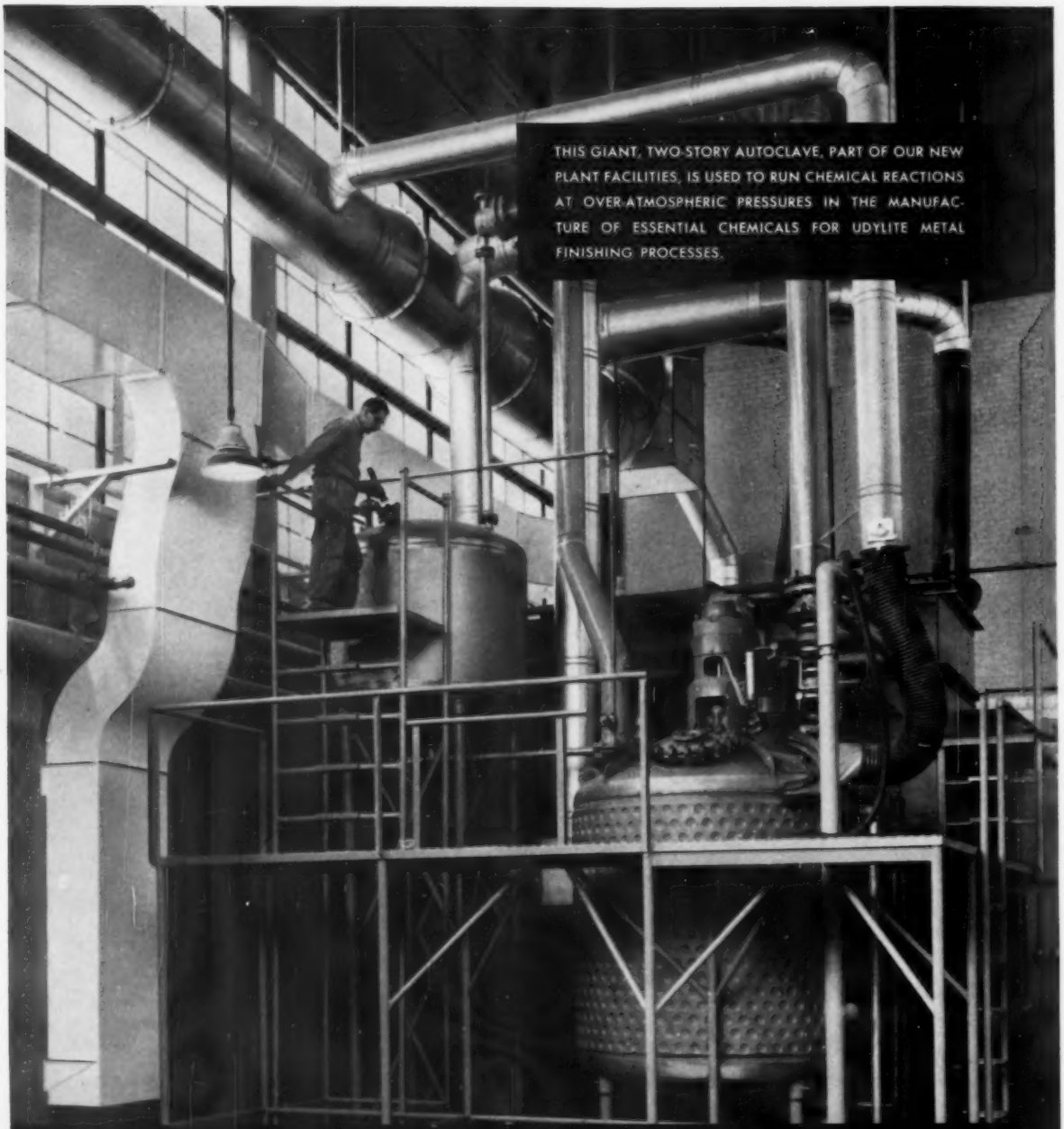

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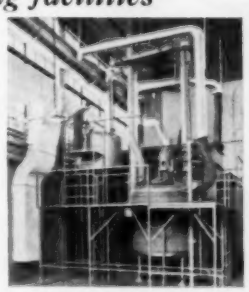

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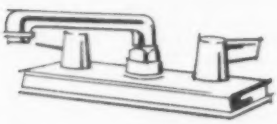
# This is LECTRITE 'Z' ...the new electrocleaner that removes all dulling films from all zinc die-cast alloys. Use it for side-view mirrors or refrigerator handles . . . plumbing fixtures  or furniture hardware. You'll get streak-free, shadow-free plating every time!

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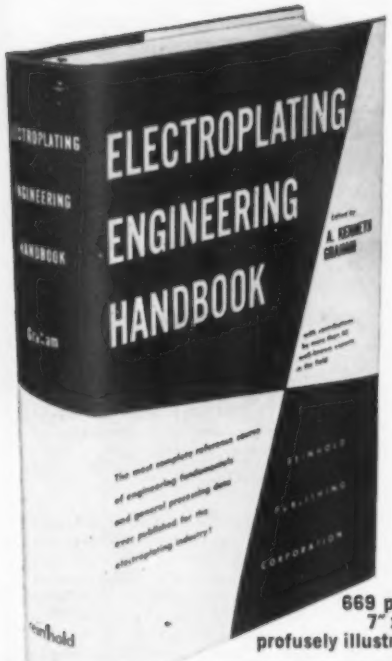


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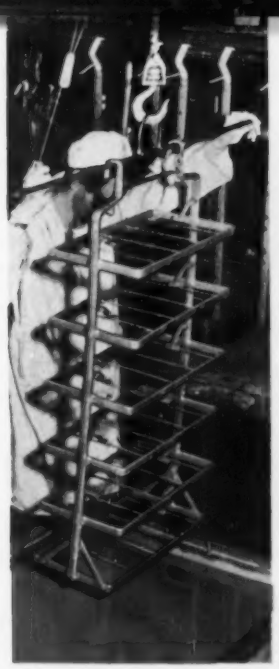

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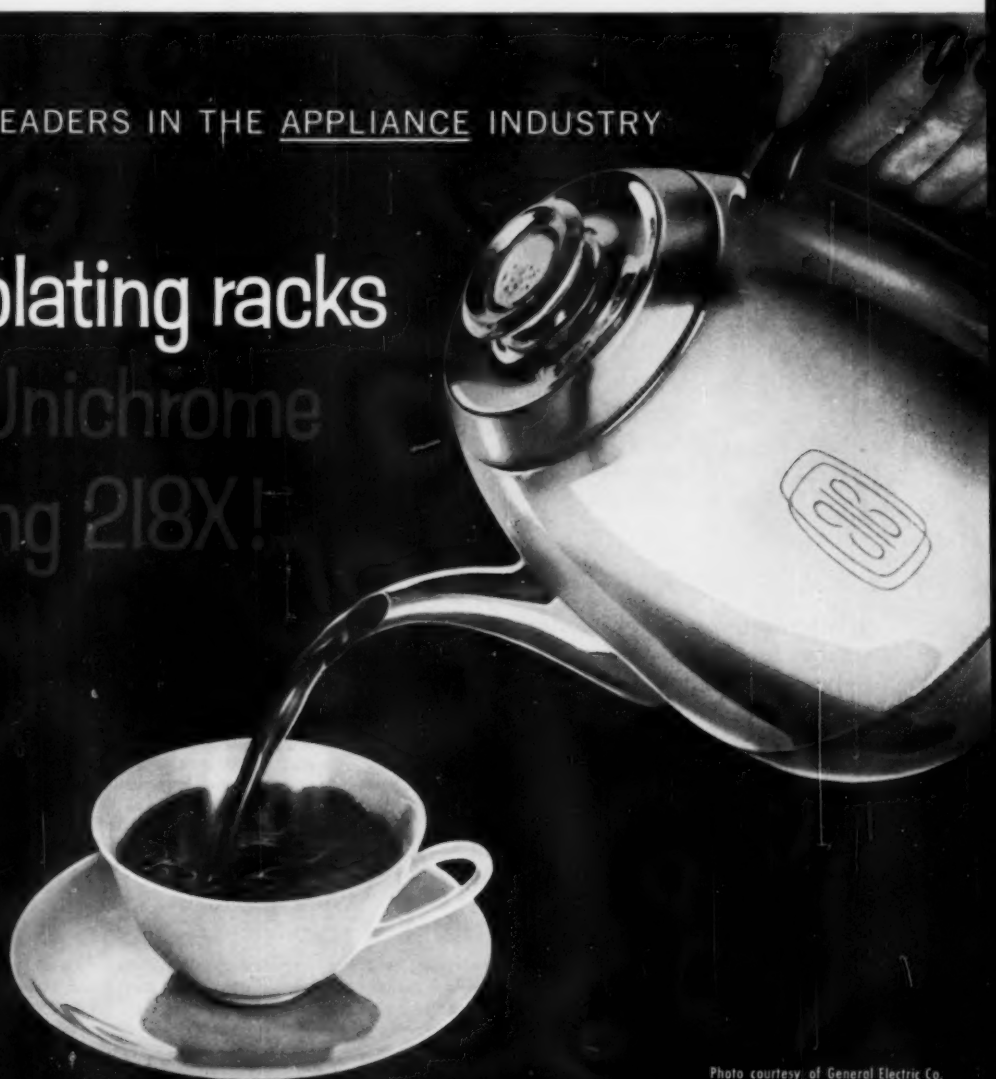

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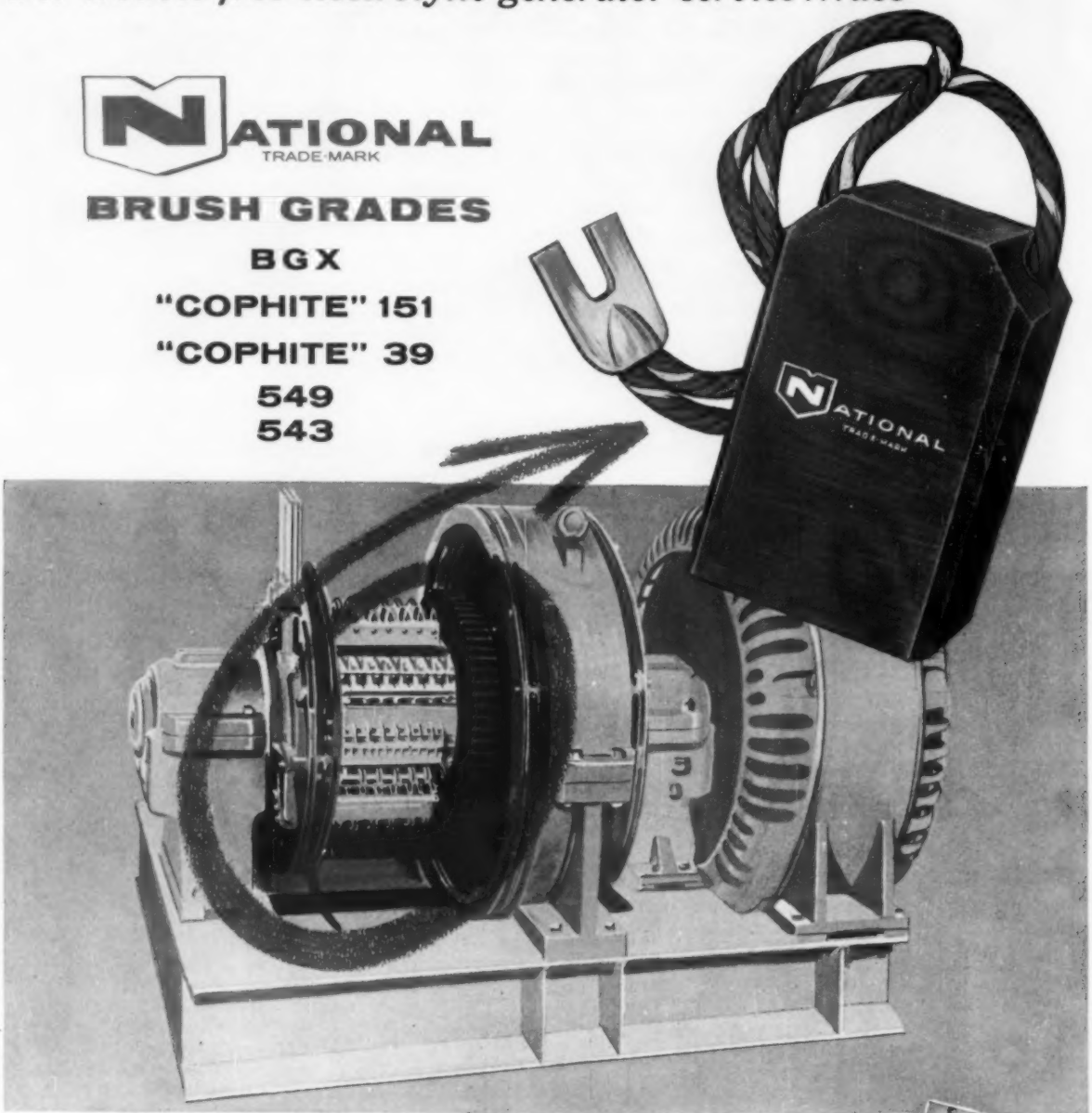


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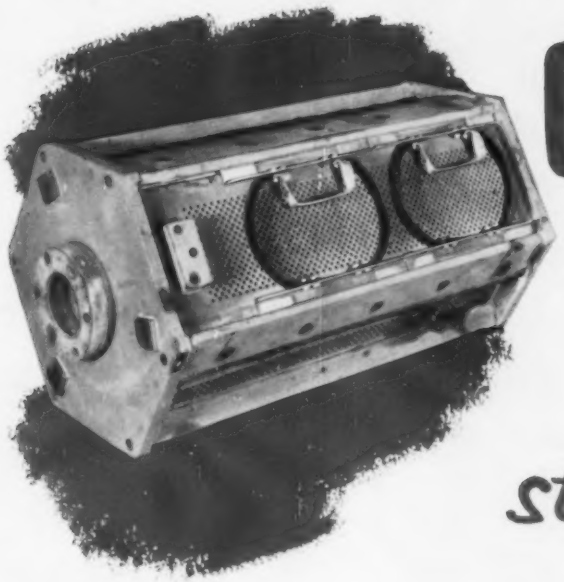

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# USE OF DISODIUM M-BENZENEDISULFONATE AS A HARDENING AGENT IN A WATTS NICKEL BATH

by WILLIAM H. METZGER JR., PAUL A. KRASLEY and FIELDING OGBURN*


## ABSTRACT

A request from the Bureau of Engraving and Printing for an electrodeposit of nickel that was harder and more free of stress than those currently obtained from a Watts bath operated at 5 amp/dm², 50C, and pH 5.0 resulted in a recommendation for the use of disodium m-benzenedisulfonate as an addition agent. The electrodeposits made in the presence of this agent had the physical properties required by BEP for their new printing plates, while production conditions remained the same.

The agent increases deposit hardness to a maximum of 350 VHN at a concentration of 0.3 g/l and above, under the operating conditions stated. The stress varies from 20,000 psi tensile to 5,000 psi compressive over a range of concentration of the additive from zero to 0.4 g/l. This agent causes hardness to vary inversely with pH in the range studied (pH 4.0–5.0). The relative stability of the agent appears unaffected by convenional purification procedures. Intercomparisons with two spiral contractometers and four coils show that, within the 10 per cent experimental error, significant variations in stress can be accounted for in the surface condition of the coils, the "stop-off" procedure inside the coil, and the mechanical differences between individual contractometers.


## INTRODUCTION

With the introduction of the high speed rotary presses at the Bureau of Engraving and Printing, the need arose for a relatively thin all-nickel electroformed intaglio printing plate. The Watts[1] type bath yielded nickel electroforms which on repeated printings sustained as much as a 0.1 per cent elongation, a characteristic which caused some difficulty in the registration required in the second printing. Though few plates were damaged sufficiently to interfere with printing, it was thought that a harder nickel would eliminate the elongation of the printing plate, as well as the paper-crease marks sustained in the chromed face. A reduction of internal stress would be advantageous in the electroforming procedure. The nickel must be sufficiently ductile to withstand a 90-degree bend over a ¼-inch radius, because of the method of attaching the printing plates on the press.

## LABORATORY INVESTIGATION

A number of nickel baths were given a preliminary evaluation and were found to be unsatisfactory. A proprietary nickel sulfamate bath was unsatisfactory because of poor anode corrosion at the desired current density. (While this shortcoming can be somewhat alleviated by increasing the anode area, this adjustment was not known at the time.) Two additives were used in the conventional sulfamate bath, as described by Newell.[2] The rate of consumption of p-toluene sulfonamide was excessive; the addition of ammonium sulfate resulted in deposits having reduced ductility. Deposits from a chloride-acetate bath, with and without p-toluene sulfonamide, were highly stressed while those from a nickel sulfate-ammonium chloride bath were highly stressed and exfoliated. The Watts type bath yielded brittle deposits when p-toluene sulfonamide or 1,3,6-naphthalene trisulfonic acid were present as additives. The addition of trisodium-8-amino-1,3,6-naphthalene trisulfonate to a Watts type bath caused the *p*H of the bath to change quite rapidly during electrolysis.

A Watts bath to which small additions of disodium m-benzenedisulfonate (hereafter referred to as "hardener") had been added, gave promising results. The use of this compound, which has been used as a brightener,[3] was suggested by the work of Zentner, Brenner, and Jennings.[4] Since the deposits were suitable, and since it would be a simple matter to convert the baths at the Bureau of Engraving and Printing, a more detailed investigation of the bath was indicated.

The Watts type bath was carefully purified with hydrogen peroxide, with activated carbon, and by filtration. It was then electrolyzed until a constant deposit hardness of 190 VHN or below was obtained (about 40 amp hr/l). The conditions of electrolysis were: *p*H, 5.0; 50C; moderate agitation; and a cathode current density, 5 amp/dm². A stainless steel cathode was used so the deposit [minimum thickness 0.020 inch] could be separated from the cathode to permit measurement of the hardness of the initially deposited surface. Additions of the hardener were made and both hardness and internal stress of the deposits were determined. This was done both with and without a proprietary wetting agent in the bath.

A large part of the data is summarized in Fig. 1. This shows the increase in hardness with increasing hardener concentration and also the small change above 0.3 g/l.

In the course of these experiments, it was also observed that when 0.02 g/l of a proprietary wetting agent was added, in the absence of the hardener, there was an immediate increase in hardness, followed by an exponential decrease to the original value as the bath was electrolyzed for an additional 30 amp hr/l.

When the *p*H of a Watts bath is decreased from 5 to 4, the

*National Bureau of Standards, Washington, D. C. Mr. Krasley, formerly of the National Bureau of Standards, now is Technical Aide, Bureau of Engraving and Printing.



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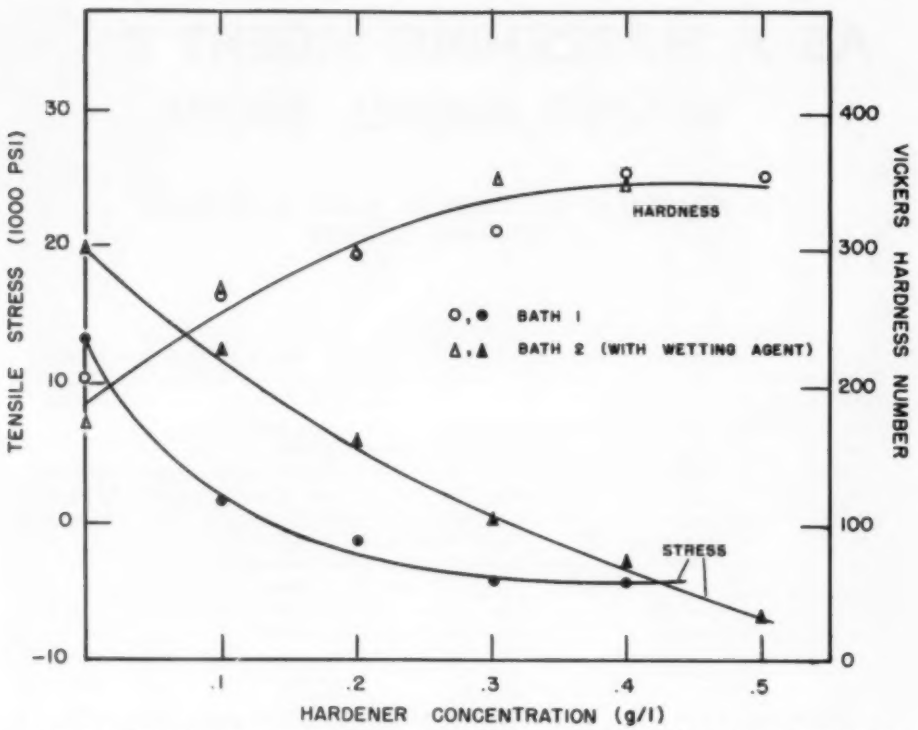


**Fig. 1.** Watts nickel bath with Disodium M-Benzenedisulfonate. C.D. 5 amp/dm²; pH 5.0; Temp. 50C.

hardness of the deposit decreases.[4] In the presence of the hardener, however, this effect was reversed. After lowering the *p*H from 5 to 4, the hardness increased and pitting occurred. When the *p*H was restored to 5.0, the hardness returned to its original value and the pitting ceased.

To estimate the rate of consumption of the hardener, a Watts bath with 0.4 g/l of hardener was operated for 100 amp hr/l. During this period, the hardness of the deposits dropped from 350 to 325 Vickers. There is no simple method of directly determining the hardener concentration, but from figure 1 it is estimated that 0.15 to 0.2 g/l of hardener was consumed. This consumption rate, which is not excessive, is somewhat higher than was subsequently encountered in actual production experience.[1]

Stress measurements were made with a single Brenner-Senderoff contractometer, with each bath being assigned its own coil. The two coils were of the same nominal measurements, and deposit thicknesses were 0.0003 inch for all stress measurements. The procedure recommended by Brenner and Senderoff of using a "stop-off" lacquer on the inside of the coil was not used because it consistently left small islands devoid of plate (sometimes called "holiday" areas), even when reasonable care was taken. When the spacing between adjacent turns is kept relatively small, very little nickel deposits inside the coil. Any error resulting from this procedure should be relatively small and constant.

The effect of the hardener on internal stress (tensile) was the inverse of the effect on hardness. The effect of the wetting agent, however, is not clear. The stress curves in Fig. 1 show the distinct difference which is associated with the presence of the wetting agent in bath 2. About one-half of the average difference between the two curves has been traced to the characteristics of the contractometer with which the stress measurements were made. Two different coils were used, one for each set of data, and a direct comparison between the coils revealed this error. Part of the difference between the two curves may reflect an initial difference between the two baths prior to addition of the wetting agent to bath 2. Though the baths gave deposits with the same hardness, one gave deposits with a tensile stress greater than the other. This result indicates that the

*NOTE:* There is much disagreement as to the reproducibility of stress measurements. The two laboratories cooperating in this work decided that an intercomparison of contractometers and coils might be of special interest. Two spiral contractometers of different manufacturers were intercompared by one operator using three separate nickel plating baths. One contractometer (1) was several years old and had been used rather extensively. It had one new and one etched coil. The other contractometer (2) was new. It was provided with two new coils. The averaged results show that the tensile stress measured with contractometer (1) was 10 per cent less with the new coil and 6 per cent more with the etched coil than the average stress measured with contractometer (2) and its new coils. An intercomparison of the data of all four coils using contractometer (2) showed that the data for the three new coils agreed quite closely and the stress determined with the etched coil was 10 per cent greater. Thus, the results indicate that some difference between contractometers, as well as the surface condition of the four coils caused a large part of the discrepancy encountered. However, the above results, except for stresses of low magnitude, are well within the 10 per cent accuracy claimed for the instrument. The results indicate that once a coil becomes etched it should be discarded.

relation between stress and hardness is not fixed, but may be influenced by some factor such as an impurity in the plating solution.

## PRODUCTION EXPERIENCE

The Bureau of Engraving and Printing has used the disodium m-benzenedisulfonate as a hardener in its plating baths for a period of nine months. Accurate data have been kept for only six months of this time. During this latter period, one 1200 liter bath was electrolyzed for 660 amp hr/l. The amount of hardener required to maintain a specified hardness range as a function of amp hr/l has not been completely constant. This is probably caused by variations in "dragout" due to daily removal of electrodeposit, by daily cleaning of anodes, and by the loss due to filter changes. The cumulative addition of 360 g of hardener to this 1200 liter bath has resulted in nickel electroforms of a constant hardness (±25 Vickers). The evidence points to the fact that, if the hardener does decompose during electrolysis, it does not interfere with the production of good nickel electroforms.

The proprietary wetting agent is also used in one plating tank in amounts necessary to maintain the surface tension of the bath below 65 dynes/cm as determined by the capillary rise tensiometer. Although the capillary rise technique was found to disagree with the DuNouy tensiometer, both in absolute values of surface tension and in the reproducibility of measurements, it has nevertheless been considered adequate for production control of the amount of wetting agent to be added to the plating bath. More frequent additions of wetting agent and more harmful decomposition products of the wetting agent are encountered than with the hardener. The bath containing the wetting agent is continuously filtered and the filters are changed when required. When the bath is treated with hydrogen peroxide and activated carbon to remove the decomposition products of the wetting agent, no noticeable loss in hardener is evident. The above treatment does, however, remove the wetting agent.

To verify the idea that decomposition products of the wetting agent are more detrimental than those of the hardener, stress measurements were made of deposits from three Watts type baths which had been in continual use for several months. Bath 1 had received daily peroxide treatments using cathode agitation. Bath 2 had received daily peroxide treatments with cathode agitation plus the addition of hardener. Bath 3 had the same hardener concentration as bath 2 plus wetting agent in a sufficient concentration to maintain the surface tension below 65 dynes/cm. Bath 1 yielded deposits with the highest tensile stress; bath 3, with intermediate stress; and bath 2, with the lowest stress. After bath 3 was purified with peroxide and carbon, the stress in resulting deposits dropped to the same value as those from bath 2.

Comparison of the stress measurements of the deposits from baths 2 and 3 indicate a significant detrimental effect due to the decomposition products from the wetting agent. The effect of purification of bath 3 indicates an insignificant effect due to decomposition products from the hardener. If the effect had been significant, purification of bath 3 would have had a still greater effect.

In conclusion, the use of the hardener has been very successful during production experience.

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# AGE HARDENING OF CHEMICAL NICKEL COATINGS

by WARREN G. LEE*

THE CHEMICAL NICKEL COATING process discussed is an "electroless plating" technique by which nickel cations are reduced at a catalytic surface to the metal by hypophosphite anions. The method† of chemical nickel deposition upon which this article is based represents an improvement over that originally proposed by Brenner.[1] Particularly, the process has the advantage of great solution stability and prolonged bath life, higher rate of deposition, better appearance of the plating and superior adhesion over the original bath formulations. Insofar as the physical structure of the electroless coating is concerned, findings reported in this article apply to all types of electroless plating. The coating obtained is actually an alloy of nickel and phosphorus consisting of about 7–12 per cent P with the balance being Ni. Metallographic studies[2] have shown that the "as deposited" structure is an amorphous solid substance with "liquid like" disorder of the atoms. Deposition of the coating on various base materials and also coating to different thicknesses have proven that this structure is invariant. It has also been shown by optical metallography[2] that the "as deposited" coating consists of layers of alternating light and dark color which appear as striations. It is believed that these striations represent periodic variations of composition due to local phosphorus concentration.

Evidence for this variability of phosphorus content in the "as deposited" coating has been supported by several observations and tests. The first evidence comes from heat treatment studies, in which, after one hour heat treatment at 600 and 700C the lines are still visible, while, after heat treatment for one hour at 800C little evidence of these lines can be found. This has been explained by a reversion of the deposit from a metastable state to one involving an equilibrium phase mixture of Ni solid solution (containing very little P) and the intermetallic compound $Ni_3P$. The distribution of $Ni_3P$ particles at 600 and 700C—showing zones or "ribbons" of sparce population—is an indication of the original P content. At 800C, the $Ni_3P$ particles have grown to a much larger size; and the original striations are barely visible. The second indirect proof for a band structure in "as deposited" electroless plating involves the results of EMF measurement obtained by the stripping of chemical nickel coatings in concentrated nitric acid. In this experiment, the coatings were anodically dissolved and the EMF was determined vs. a glass electrode. If the coating were homogeneous and the stripping rate low enough, so that no great change in solution composition could occur during the test, the EMF obtained should have a constant value. However, it was observed that this was not true. We noted periodicity in the stripping potential between a maximum value (which was constant) and a minimum value (also constant) over a period of eight hours. Finally, on taking measurements of the plating potential vs. the standard calomel electrode under steady state conditions with respect to temperature, bath composition, and *p*H, it was observed that a constant potential with respect to alloy deposition was not obtained. Instead, variations of potential with time occurred—which again supports the view that periodic variations in composition take place during deposition. It is our belief that the periodic variation in the coating composition is not unique with the process† and probably occurs in all electroless nickel plating which utilizes the hypophosphite ion as the reducing agent. The attached graph (Fig. 1) shows the experimental data.

Recently, it has been reported[2] that the kinetics of the change from solid solution to $Ni_3P$ crystals in a nickel matrix by heat treatment could be followed by hardness determinations vs. time. The published data were for the 200, 300 and 400C isotherms using inert gas shielding to avoid surface oxidation. The work we wish to report at this time is a continuation of this study at the following temperatures: 190.5, 232, 260, 288 and 315C, in natural atmosphere.

Our main reason for investigating heat treatment at low temperatures was the relatively high cost (both in equipment, supervision and maintenance) of operating on a large scale under a blanket of inert or reducing gas in the range 400–800C. It was hoped that low temperature annealing for a long period of time (above 200C but below 300C) in the natural atmosphere would result in improvements of the mechanical properties of chemical nickel coatings, without formation of an oxide film inacceptable for the sake of good appearance.

The term "age hardening" is being used for this technique since it is felt that the kinetic transformation to the equilibrium state from the meta-stable condition is a time dependent function as well as temperature dependent. In our interpretation, the final maximum hardness obtained represents the maximum conversion in the reaction

$$3Ni + P \longrightarrow Ni_3P$$

The dropping off in hardness after the maximum represents a process of slow crystal growth resulting in increased ductility and corrosion resistance of the coating. In another study with various intermetallic compounds, Westbrook[3] has obtained a correlation between the temperature of heat treatment and the hardness of the alloy. Specifically with such systems as Ni-Al, Fe-Al, and Co-Al, he has shown that $\log_{10}$ Hardness (VHN) vs. temperature in °C gives a linear relation-

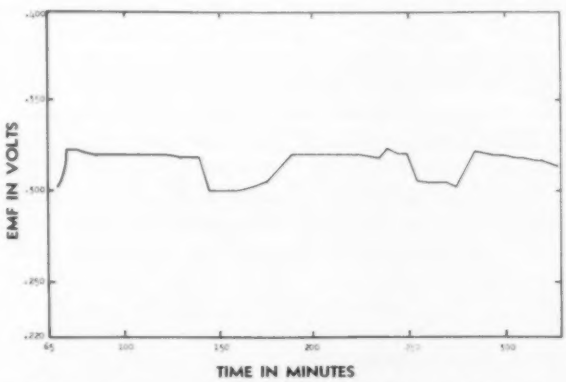


**Fig. 1.** Potential measurements of chemical nickel stripped in fuming $HNO_3$.

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†KANIGEN process patented by General American Transportation Corporation.

ship with decreasing hardness and increasing temperature (all samples being heat treated for the same length of time). This phenomenon of decreasing hardness with increasing temperature (at constant time) has been reported[2] previously for our coating. The Vickers Hardness Number values for one hour annealing at 400, 500, 600, 700 and 800C were 1195, 980, 739, 665 and 544. On plotting these data on semi-log paper according to Westbrook's correlation, a linear relationship is also obtained.

In the work discussed here, 20 $cm^2$ Armco steel coupons were coated to a thickness of 3–5 mils using a standard acid proprietary plating bath.* The phosphorus content of the resulting coating ranges between 8–10 per cent. It should be pointed out, however, that the data on "age hardening" apply over a broad range of phosphorus analyses in electroless coatings.

*KANIGEN bath.

The general range of phosphorus in electroless coatings produced in acid baths varies between 6–14 per cent. The samples after plating were annealed in a thermo-regulated hot air furnace. The actual temperature of heat treatment was measured with a chromel-alumel thermocouple which was checked against the melting point of aluminum, sulfur, and a constant temperature oil bath. At various times, samples were removed from the furnace and allowed to cool to room temperature. The samples were then lightly buffed to remove any oxide film and the VHN determined. Hardness determinations were made using a Bausch and Lomb Research Metallograph and an Eberbach diamond pyramid indenter. The indentation unit was first calibrated using a 100 gram spring load. After calibration, the indenter unit was mounted on the microscope. The specimen was then placed on the microscope stage and clamped securely. By varying the microscope adjustments, 5–10 diamond im-

**TABLE I**

**EFFECT OF ANNEALING TIME ON VHN AT VARIOUS ISOTHERMS**

| Temp. °C | Time in Hours | Vickers Hardness Number | Remarks | Temp. °C | Time in Hours | Vickers Hardness Number | Remarks |
|---|---|---|---|---|---|---|---|
| 190.5 (374F)..... | 0 | 550–600 | — | 232 (*Continued*) | 372 | 750 | — |
| | 1 | 575–600 | — | | 412 | 750 | — |
| | 2 | 600 | — | | 483 | 750 | — |
| | 3 | 600 | — | | 539 | 750 | — |
| | 4 | 600 | — | | | | |
| | 6 | 600 | — | 260 (500F)..... | 0 | 500 | — |
| | 7 | 600 | — | | 1 | 550 | — |
| | 8 | 600 | — | | 2 | 550 | — |
| | 16 | 600 | — | | 5 | 550 | — |
| | 24 | 600 | — | | 8 | 550 | — |
| | 40 | 600 | — | | 10 | 750 | — |
| | 56 | 600 | — | | 16 | 750 | — |
| | 72 | 600 | — | | 21 | 750 | — |
| | 159 | 600 | — | | 25 | 800 | — |
| | 216 | 600 | — | | 49 | 800 | — |
| | 264 | 600 | — | | 65 | 800 | — |
| | 410 | 600 | — | | 71 | 850 | — |
| | 617 | 600 | — | | 79 | 750 | — |
| | | | | | 96 | 750 | — |
| 232 (449.6F)..... | 0 | 500 | — | | 123 | 750 | — |
| | 1 | 500 | — | | | | |
| | 2 | 550 | — | 288 (550.4F)..... | 0 | 500 | — |
| | 3 | 575 | — | | 1 | 650 | — |
| | 4 | 600 | — | | 2 | 750 | — |
| | 5 | 600 | — | | 18½ | 950 | — |
| | 7 | 600 | — | | 23½ | 950 | Sl. oxide film |
| | 8 | 600 | — | | 90 | 950 | Oxide film |
| | 16 | 600 | — | | | | |
| | 24 | 600 | — | 315.6 (600F)..... | 0 | 500 | — |
| | 28 | 825 | — | | 1 | 750 | — |
| | 32 | 825 | — | | 2 | 750 | Sl. oxide film |
| | 40 | 925 | — | | 3 | 750 | Sl. oxide film |
| | 48 | 925 | — | | 4 | 950 | Oxide film |
| | 72 | 925 | — | | 5 | 950–1000 | Oxide film |
| | 96 | 925 | — | | 6 | 950 | Oxide film |
| | 256 | 850 | — | | 22½ | 950 | Oxide film |

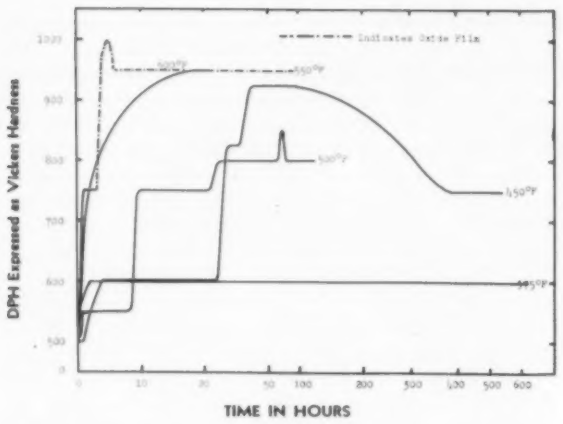


**Fig. 2.** Isotherms for heat treatment of chemical nickel deposits.

pressions were made at intervals. Measurements of the diamond indentation were made with a micrometer eyepiece under high magnification. By measuring the diagonal of the indentation in millimeters and averaging these values, the hardness in VHN was calculated by means of the formula:

$$H = 1.8544\ L/d^2$$

where L = load in Kg., d = length of diagonal indentation in millimeters and H = VHN.

Five to ten measurements were made on each specimen in different areas, and the average VHN reported as the hardness of the sample. Table I gives the results of our study.

The results show that, the higher the annealing temperature, the shorter is the time required to reach maximum hardness. Our data also confirm those previously reported[2] at the 200C isotherm, in which no change in hardness occurred after reaching 650 VHN, at the end of 21 hours of heat treatment. In our study, no change was observed after reaching 600 VHN after 617 hours of annealing.

Heat treatment at 232C results in maximum hardness (925 VHN) after 40 hours. The 260C curve appears abnormal, as it does not reach a VHN value over 850. Moreover, one would expect that the peak of the hardness curve would be reached within a shorter time interval than for the previous isotherm (e.g. at about 25–30 hours). We question some of the VHN data in this case, although determinations were careful; but have reported the data as obtained in our experiment. By heat treatment at 288C, maximum hardness is reached somewhere between 2 and 18½ hours; but oxidation can be observed after 23 hours of annealing.

From a practical point of view, a temperature of about 280C for 15–20 hours in an ordinary furnace, without protective atmosphere, appears suitable for obtaining maximum hardness and wear resistance. On the other hand, for maximum impact resistance, a lower temperature (240–260C) and a longer annealing period is recommended.

Unfortunately, at this time, we do not have results on the metallographic structure of the samples annealed at the various isotherms studied. The information gained from such work will tell how far the dispersion of $Ni_3P$ in a matrix of Ni has progressed for a given annealing temperature and time. We can, however, speculate on some of the physical property changes which will occur, based on studies made at higher temperature. There will very definitely be an improvement in wear resistance with the maximum wear corresponding to the highest hardness value. For example, the following table gives our results on T.W.I. (Taber Wear Index) measurements and hardness (in VHN) vs. time at one heat treatment temperature. The results clearly show that the maximum wear resistance occurs at the highest hardness.

**EFFECT OF ANNEALING TIME AT 621.2C (1150F) ON T.W.I. AND VHN**

| Time in Hours | T.W.I. | VHN |
|---|---|---|
| 0 (As Deposited)* | 15.62 | 600 |
| 1 | 4.89 | 750 |
| 2 | 3.43 | 800–840 |
| 3 | 4.88 | 750 |
| 4 | 4.18 | 700 |
| 6 | 3.90 | 650 |

We also know, based on studies carried out at higher temperature, that increased ductility and resistance to impact of the chemical nickel coating* can be obtained by annealing for a time which corresponds to hardness values lower and beyond the maximum of the hardness vs. time curve. Specifically, this means that annealing should be done for a period of time which will take the coating hardness past the maximum and then down again, with maximum ductility being obtained at the lower VHN values.

This study has shown that maximum hardness for chemical nickel coatings* can be obtained at temperatures lower than the 400C transformation point of the as-deposited amorphous alloy to the equilibrium phase mixture of Ni and $Ni_3P$. The process is time dependent (has been demonstrated previously). The value of annealing chemical nickel* at lower temperatures is that properties such as high hardness, improved wear resistance, and ductility can be obtained in an ordinary furnace, without recourse to an inert atmosphere, which is always costly. Finally, at some annealing temperatures, there are indications that increased corrosion life is also realized.

* KANIGEN patented process.

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**Warren G. Lee** was born in Abington, Pennsylvania, in 1924, and received his BS degree in chemistry from Roosevelt College in 1950. He has just completed graduate studies at the Illinois Institute of Technology for the PhD degree in chemistry. The major field of study was in physical organic chemistry with minors in chemical kinetics and radio-radiation chemistry. He began work for General American Transportation Corporation in 1951 and presently holds the position of research associate. He has engaged in research and development work for G.A.T.X. in the field of electroless nickel plating and corrosion.

# ELECTROPHORETIC DEPOSITION OF METALS, METALLOIDS, AND REFRACTORY OXIDES*

by VERNON A. LAMB and WALTER E. REID JR.†

Operating conditions are defined for electrophoretically depositing a number of metals, metalloids, and refractory oxides. Conversion of the deposits to practical coatings requires treatments such as chemical reduction and sintering. Further development of the latter steps is necessary before practical coatings can be achieved. Coatings of titanium-nickel alloys on steel may warrant further investigation.

## 1. INTRODUCTION

ELECTROPHORETIC DEPOSITION is a process in which colloidal particles, suspended in a liquid medium, migrate in an electric field and deposit on an electrode. Migration occurs because the particles are electrically charged, either positively or negatively, depending on the composition of the system. The theory of electrophoresis is discussed elsewhere.

Many processes based on electrophoretic deposition have been described.[2-9] The deposition of rubber from latex suspensions and the deposition of glassy silicate coatings on wire, which serve as high-temperature electrical insulation, are two examples that may be mentioned. A recent application of the process is the production of nickel-chromium alloy coatings.[9]

Some of these processes are in commercial use. In general, however, electrophoretic deposition has not been widely adopted by industry. One reason is that the same types of coatings can often be applied at lower cost by other procedures. Nevertheless, electrophoretic deposition has several advantages that make it attractive and justify continued development. These advantages are indicated as follows: (1) an electrophoretic coating is denser than one applied by dipping or spraying; (2) the thickness of the coating can be closely controlled; (3) objects of irregular shape acquire a coating that is fairly uniform in thickness, because when points and edges have been covered, the insulating effect of the coating on these areas diverts the current to recessed areas; (4) the rate of deposition is high because the deposited particles have a high ratio of mass to charge. (Under typical operating conditions, an electrophoretic deposit attains a thickness of 0.001 inch in about 10 seconds, whereas an electrodeposit of the same thickness may require 30 to 60 minutes).

This laboratory has been engaged in a series of researches on the development of methods for depositing refractory metals, such as tungsten, molybdenum, and titanium, from organic or fused-salt baths, since these metals have not been deposited from aqueous solutions.[10, 11] It appeared that electrophoretic deposition was a promising approach to the problem of producing coatings of these metals. Additional potential uses of this process are the deposition of other metals and metalloids which cannot be deposited from aqueous solutions, such as aluminum, germanium, and silicon, and compounds such as barium titanate. These materials are obviously not in usable forms as deposited, but may be converted to usable forms by heat-treatment, to sinter and bond them to the basis material.

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## 2. PREPARATION OF COATINGS

Preparation of coatings consists of three steps: (a) preparation of suspensions; (b) deposition; and (c) subsequent treatment to reduce, sinter, and densify the coatings.

### 2.1 Preparation of Suspensions

Preparation of suspensions by the arc method and by mechanical milling was investigated. Other possible methods, such as pulverization in an ultrasonic field or condensation,[1] were not studied because mechanical milling proved to be adequate and convenient.

The Svedberg modification of the Bredig arc method[12] was used in attempts to produce suspensions of titanium and tungsten. The arc was struck between electrodes of the metal submerged in various suspension media contained in a glass cell. Power was supplied by a 15 KVA, high-frequency source (500 kc). In all experiments the rate of dispersion was low and the suspensions were unstable. With water as the suspension medium the metals formed oxides. Organic suspension media, including several ethers and hydrocarbons, decomposed to form carbon and tarry materials. It was concluded that the arc method is not suitable for preparing suspensions of these hard, refractory metals.

Mechanical grinding in a ball-mill appeared to be the simplest of the other possible methods. Milling was carried out in a small porcelain jar of 200-ml capacity. In most cases flint pebbles were used as grinding balls, though steel or alundum balls were occasionally used. Contamination of the material, as a result of wear of the balls and mill-wall, was not considered significant. Duration of grinding depended on the hardness and friability of the material and on its initial particle size. It was found empirically that some materials yielded suspensions from which deposits could be obtained after a very short period of grinding, while others required 24 hours or more. Variables of ball-mill operation have been discussed by Fischer.[13]

The grinding procedure was as follows: One or two grams of the material to be suspended was placed in the jar with 5 to 10 ml of suspension medium and the jar was filled to about one-half its volume with grinding balls. After grinding for 50 to 75 per cent of the total period, the mixture was diluted with additional suspension medium to give a total volume of 50 to 100 ml, depending on the concentration desired, and grinding was continued. At this point, a stabilizing ionic material, such as a wetting agent, was usually added. Some suspensoids, e.g., barium titanate, yielded suspensions from which deposits could be obtained after very brief grinding with a paint-pigment muller, or even after 5 to 10 minutes

TABLE I

ELECTROPHORETIC DEPOSITION EXPERIMENTS

| Experiment No. | Solvent | Suspensoid: Material | Suspensoid: Conc (g/100 ml) | Additive | Milling time (hr) | Field strength (v/cm) | Remarks |
|---|---|---|---|---|---|---|---|
| 1 | Gasoline | Titanium hydride | 1.0 | None | 18 | 4000 | Slight deposit on both electrodes. |
| 2 | Gasoline | Titanium hydride | 1.0 | Igepal CA* | 18 | 500 | Trace deposit on cathode only. Good deposit at 4000 v/cm. |
| 3 | E 141 ether | Titanium hydride | 1.0 | None | 18 | 150–300 | Very thin deposits. Deposition ceased immediately. |
| 4 | E 141 ether | Titanium hydride | 1.0 | None | 18 | 1100 | Minimum voltage for good deposit on anode. |
| 5 | E 141 ether | Titanium hydride | 1.0 | Triton K60*** | 18 | 300 | Minimum voltage for good deposit on anode. |
| 6 | E 141 ether | Titanium hydride | 1.0 | Penetrol 60† | 18 | 150 | Good deposit on anode. |
| 7 | E 141 ether | Titanium hydride | 1.0 | $TiCl_4$ | 18 | 200 | No deposit. Suspension coagulated if conc of $TiCl_4$ $>10^{-3}$ per cent. |
| 8 | E 141 ether | Titanium hydride | 1.0 | $AlCl_3$ | 18 | 200 | No deposit. Suspension coagulated if conc of $AlCl_3$ $>10^{-3}$ per cent. |
| 9 | E 141 ether | Titanium hydride | 1.0 | Ethyl-cellulose | 18 | 150 | No deposit. |
| 10 | E 141 ether | Titanium hydride | 1.0 | Ethyl-cellulose | 18 | 300 | Very slight deposit. Deposition ceased immediately. |
| 11 | E 141 ether | Titanium hydride | 1.0 | Ethyl-cellulose | 18 | 1100 | Good deposit on anode. |
| 12 | E 141 ether | Titanium hydride | 1.0 | Carboxymethyl-cellulose | 18 | 1100 | No deposit. |
| 13 | E 141 ether | Titanium hydride | 1.0 | Tannic acid | 18 | 150 | Very slight deposit. |
| 14 | E 141 ether | Titanium hydride | 1.0 | Tannic acid | 18 | 300 | Good deposit on anode. |
| 15 | E 141 ether | Titanium hydride | 1.0 | Triethanolamine | 18 | 700 | Very slight deposit. Deposition ceased immediately. |
| 16 | E 141 ether | Titanium hydride | 1.0 | None | 18 | 1100 | No initial deposit from spoiled solvent that had been treated 4 hr with sodium. Deposit formed after a period of electrolysis. |
| 17 | E 141 ether | Titanium hydride | 1.0 | None | 18 | 1100 | Good deposit on anode from spoiled solvent that was sodium-treated for 2 days. |
| 18 | E 141 ether | Titanium hydride | 1.0 | None | 18 | 1100 | Good deposit on anode from spoiled solvent that was treated with $LiAlH_4$ and distilled. |

*(Continued on following page)*

TABLE I

*(Continued)*

ELECTROPHORETIC DEPOSITION EXPERIMENTS

| Experiment No. | Solvent | Suspensoid: Material | Suspensoid: Conc (g/100 ml) | Additive | Milling time (hr) | Field strength (v/cm) | Remarks |
|---|---|---|---|---|---|---|---|
| 19 | Methyl alcohol | Titanium hydride | 4.7 | None | 18 | 50 | Poor deposits on cathode after about 5 min induction periods. |
| 20 | Methyl alcohol | Titanium hydride | 4.7 | $Mg(NO_3)_2$ 0.17 g/l | 18 | 7 | Same results with corresponding zirconium hydride dispersions. Each alcohol dried with $CaH_2$ and distilled (15). |
| 21 | n-Butyl alcohol | Titanium hydride | 4.7 | None | 18 | 1100 | |
| 22 | Isopropyl alcohol | Titanium hydride | 4.7 | None | 18 | 1100 | |
| 23 | Ethyl alcohol | Titanium hydride | 1.0 | None | 18 | 1100 | No deposit. |
| 24 to 29 | Ethyl alcohol | Titanium hydride | 1.0 | See remarks | 18 | 1100 | No deposit with any of the following agents: Penetrol 60, Igepal CA, Triton K-60, ethanolamine, tannic acid, ethyl cellulose. High conductivity of suspensions resulted in rapid heating to boiling. |
| 30 | 1-Nitropropane | Titanium hydride | 1.0 | None | — | 1100 | Good deposit on cathode. No deposit at 300 v/cm. |
| 31 | 1-Nitropropane | NiO | 1.0 | Ethyl cellulose 50 mg/100 ml | — | 150 | Good deposit on cathode. |
| 32 | E 141 ether | NiO | 1.0 | None | — | 150 | No deposit. |
| 33 | Cetane | $BaTiO_3$ | 2.0 | Triton K-60 | 23 | 150 | No deposit. |
| 34 | n-butyl ether | $BaTiO_3$ | 1.0 | None | 18 | 1100 | No deposit. Same result with Na-dried solvent. |
| 35 | Dimethoxyethane | $BaTiO_3$ | 2.0 | None | 18 | 1100 | No deposit. |
| 36 | Dimethoxyethane | $BaTiO_3$ | 2.0 | Penetrol-60 | 18 | 300–1100 | Good deposit on anode. Suspensions unstable. |
| 37 | Acetal | $BaTiO_3$ | 2.0 | None | 24 | 1100 | No deposit. |
| 38 | E 141 ether | $BaTiO_3$ | 2.0 | None | 18 | 150 | Good deposit on anode, but not consistently without wetting agent. |
| 39 | E 141 ether | $BaTiO_3$ | 2.0 | Aerosol-OT‡ 200 mg/100 ml | 18 | 500 | Deposit on cathode with high concentration of wetting agent. |
| 40 | E 141 ether | $BaTiO_3$ | 2.0 | Penetrol-60 50 mg/100 ml | 18 | 150 | Good deposit on anode. |
| 41 | E 161 ether‡‡ | $BaTiO_3$ | 2.0 | Penetrol-60 | 24 | 1100 | Poor deposit on anode. |
| 42 | Cyclohexanone | $BaTiO_3$ | 2.0 | Penetrol-60 | 18 | 1100 | No deposit. |
| 43 | Tetrahydrofuran | $BaTiO_3$ | 2.0 | None | 18 | 1100 | No deposit. Suspension unstable. |
| 44 | Pyridine | $BaTiO_3$ | 2.0 | None | 18 | 300 | Good deposit on cathode. |
| 45 | Nitropropane | $BaTiO_3$ | 2.0 | None | 24 | 150 | Good deposit on cathode. |
| 46 | Water | $BaTiO_3$ | 2.0 | None | 24 | 150 | No deposit. Conductivity too high for higher voltage. |

Notes:
*Igepal CA, non-ionic wetting agent, General Dyestuff Corporation.
**E 141 ether, diethyleneglycol dimethyl ether, Ansul Chemical Company.
***Triton K-60, cationic wetting agent, Rohm and Haas Chemical Company.
†Penetrol-60, anionic wetting agent, The Beacon Company.
‡Aerosol OT, anionic wetting agent, American Cyanamid and Chemical Corporation.
‡‡E 161 ether, triethyleneglycol dimethyl ether, Ansul Chemical Company.

of hand-grinding in a mortar. Suspensions prepared by the latter procedures were less stable and settled out more quickly than those prepared by prolonged ball-milling. None of these milling procedures yielded stable colloids. A substantial fraction of the suspensoid settled from an unstirred suspension within a few minutes. It was therefore necessary during deposition to stir the suspensions gently to prevent settling. More finely milled suspensions, even though more stable, were undesirable because the deposits formed from them had greater tendency to form shrinkage cracks during drying and firing than did deposits made from coarser suspensions.

Most of the materials used were procured as powders with particles in the size range of 1 to 10 microns. The milling procedure probably reduced the particle size slightly, but observations with the ultramicroscope indicated that the main effect of milling was the fragmentation of clumps of particles. The sizes of the particles in the milled suspensions were not measured.

### 2.2 Equipment and Procedures Used for Deposition.

The following equipment was used: (1) a variable d-c power supply, with a maximum capacity of 0.5 ampere at 4000 volts; (2) a deposition cell, which was a 50-ml beaker, fitted with two steel panels as electrodes, 1 x 5 cm, and equipped with a small glass stirrer; and (3) auxiliary items, including a milliammeter, a reversing switch, and a current-limiting series resistance of 0.1 megohm.

Operation consisted simply of transferring the suspension to the cell, inserting the electrodes, and applying the voltage. A typical value of the deposition current was 0.3 ma at 500 v on 1 x 5 cm electrodes. Under these conditions most suspensions yielded deposits with a thickness in the range of 0.001 to 0.002 inch in 20 seconds.

### 2.3 The Suspension Medium

Sixteen substances were tried as suspension media. They are listed in Table I. These media may be classed as nonpolar, including gasoline and cetane; slightly polar, e.g., ethers; and strongly polar, including alcohols, nitroparaffins, and water.

Several patents on electrophoretic deposition specify water or the lower alcohols as suspension media.[14, 15] It was our experience that these materials have limited applicability. Suspensions can be formed in them readily, but in most cases good deposits were not obtained, because gassing at the electrodes disrupted the deposits. Rapid flocculation during electrolysis was also noted, which was probably caused by the heating that resulted from the relatively high currents through these suspension media, and by ions formed as a result of solvent-electrode reactions (Table I, expt. 19 to 29, 46).

Hydrocarbons were also unsuitable as suspension media. In the absence of surface active agents, no deposits at all were obtained from hydrocarbons at potentials up to 1000 v/cm. However, at 4000 v/cm, trace deposits formed on both electrodes from suspensions of titanium hydride in gasoline. The probable explanation of this behavior is that the particles become polarized in the strong field and therefore migrate to the electrodes. If a surface active agent, e.g., Igepal CA, was added to this system, trace deposits were obtained on the cathode at 500 v/cm, and good deposits at 1100 to 4000 v/cm. This result indicates that even in the presence of the wetting agent, only a very small charge is present on the particles, and consequently a very strong field is required to effect deposition (Table I, expt. 1, 2, 33).

Organic liquids of intermediate polarity were found to be the best suspension media. Diethyleneglycol dimethyl ether (hereafter referred to as E 141 ether; see note, Table I) and pyridine formed suspensions from which good deposits were obtained with most of the suspensoids studied. Most oxides, but neither titanium nor zirconium hydrides, deposited readily from suspensions in nitropropane.

### 2.4 The Effect of Wetting Agents and Other Additives

The three solvents named above as the most effective suspension media (E 141 ether, pyridine, and nitropropane) formed suspensions from which deposits could be obtained without the addition of any other component to the mixture. However, addition of a wetting agent improved the suspensions in these media by (a) increasing their life, (b) permitting formation of thicker deposits, and (c) reducing the voltage require to deffect deposition. The results of experiments 3 to 6, Table I, illustrate (b) and (c). Addition of $TiCl_4$ and $AlCl_3$ (Table I, expt. 7, 8) did not improve the deposits and caused the suspensoid to coagulate. Some suspension media from which deposits could not be obtained yielded deposits if a wetting agent was added. This is illustrated in Table I, expt. 35 and 36. Several interesting specific effects were noted. For example, in experiment 40, it is seen that a suspension containing 50 mg of Penetrol 60/100 ml yielded deposits on the anode. The same concentration of Aerosol OT (expt. 39) suppressed deposition, but when its concentration was increased to 200 mg/100 ml a deposit appeared on the cathode. An explanation is not apparent, because both Penetrol 60 and Aerosol OT are anionic wetting agents.

Several polymers such as ethyl cellulose and cellulose acetate were tried as additives. Ethyl cellulose was used by Shyne and coworkers[9] as a "binder," and cellulose nitrate was used by Oakes[16] and Schneider.[17] By themselves, these materials are not very effective in converting a non-depositable suspension to one from which good deposits were obtained. However, used in amounts of about 5 per cent of the weight of suspensoid, these materials effectively increase the "green strength" of a deposit. The gelatinous nature of the polymer increases the cohesion and decreases the powdery character of a deposit. Specific compatibility effects were noted for these materials. For example, ethyl cellulose is effective in systems in which the deposit forms on the cathode, such as nickel oxide in nitropropane. However, cellulose acetate in this system prevents deposition. Conversely, with barium titanate in E 141 ether, the deposit forms on the anode. Ethyl cellulose prevents deposition in the latter system, whereas cellulose acetate is compatible.

### 2.5 The Effect of Impurities in Suspensoid Systems

Sometimes suspensions in E 141 ether, from which deposits should have been obtained, failed to yield deposits. Usually this occurred when the ether in a partially filled supply bottle had been exposed to the atmosphere repeatedly. It was suspected that the accumulation in the ether of moisture, hydrolysis products, or peroxides, was responsible for its failure to produce a depositable suspension. Several drops of water added to a good suspension did not affect depositability, so it does not seem that moisture interferes as such. No further effort was made to identify the impurity responsible for this effect. It was found that if "spoiled" ether was treated with sodium, it subsequently yielded suspensions from which deposits could be obtained. However, a long period of treatment was required, as shown in Table I, expt. 16 and 17. The sodium reaction products were left in the ether. Treating

the ether with $LiAlH_4$, followed by distillation (Table I, expt. 18), was also effective.

### 2.6 Heat-treatment and Compaction of Deposits

Electrophoretic deposits as formed are fairly firm and compact after the suspension medium has drained and evaporated. They can be handled without damage if reasonable care is used. However, conversion to a strong, sound end-product requires heat-treating, in some cases to effect chemical conversion and in all cases to produce sintering. For example, titanium hydride deposits are converted to titanium metal by heating at about 800C, but a much higher temperature is required to sinter the titanium. Oxide coatings may require heating in a reducing atmosphere, e.g., hydrogen, to effect conversion to metal. On the other hand, barium titanate, which is desired as such, must be heated in an oxidizing atmosphere to prevent decomposition. Sintering of a coating requires that it be heated to a temperature fairly close to its melting point, but this temperature of course cannot exceed the melting point of the basis metal. Both wire-wound tube furnaces and an induction furnace were used for sintering. They were equipped for atmosphere control.

In general, sintering alone results in a deposit which is relatively porous. Compacting the deposit before sintering was tried in an effort to reduce the porosity of the sintered coating. Application of hydraulic pressure up to 60 tons/in$^2$ was not successful, owing to the tendency for this treatment to break the deposit loose from the basis metal. Compacting by rolling after sintering has been applied by others[9] to ductile metal coatings. Limited trials were made of hot-rolling in the furnace during sintering, but the technique is difficult and was not developed to a successful or practicable stage.

### 2.7 Deposition of Specific Materials

#### A. Deposition of Titanium and Titanium Alloys

The toughness of titanium metal prevented successful preparation of suspensions by ball-milling. Titanium hydride, which is brittle, was found to reduce easily to a sufficiently fine powder. Suspensions prepared as in Table I, expt. 5 and 6, yielded satisfactory deposits.

Attempts were made to convert the deposits to sound metal coatings by heating them at 1100C in a vacuum or an inert atmosphere. However, the deposits sintered incompletely, cracked due to shrinkage, and were bonded only weakly to the basis steel. One would expect that a temperature in the range from 1500 to 1600C would be required for complete sintering. However, the basis steel cannot be heated above about 1400C. In view of the shrinkage that occurred at 1100C, it appeared that a higher sintering temperature would still fail to yield good coatings. Therefore, improvement was sought by codepositing an alloying constituent. From a survey of the literature, it was concluded that the following are the most promising alloying metals: Al, Be, Cr, Mn, Mo, Ni, Ta, W, and Zr.

TABLE II

SUMMARY OF DEPOSITION EXPERIMENTS FOR SEVERAL MATERIALS DEPOSITED FROM SUSPENSIONS IN E 141 ETHER

| Material | Additive | Milling time (hr) | Field strength (v/cm) | Description of deposit** | | | Sintering conditions | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | As deposited | After drying | After sintering | Time (hr) | Temp (°C) | Atmosphere |
| *Al (flake powder) | 5% Cellulose acetate + Penetrol-60 | 16 | 300 | Smooth, firm | Crack-free | Contained oxide, powdery | ½ | 860 | $H_2$ |
| $GeO_2$ (freshly fused "glass") | None | 16 | 1100 | Smooth, firm | Crack-free | Adherent alloy film next to steel, mostly oxidic, powdery | ½ | 820 | $H_2$ |
| *Ge | None | ½ | 1100 | Smooth, firm | Crack-free | Uneven, flowed coating, oxide surface | 0.2 | 1000 | $H_2$ |
| *Ge | 5% Cellulose acetate | ½ | 4000 | Harder than above | Crack free | Adherent alloy film next to steel, mostly oxidic, | ½ | 800–950 | $H_2$ |
| Si | None | ½ | 300–1100 | Smooth, firm | Crack-free | Oxidic, slight sintering and adhesion | 1 | 1350 | He |
| *$WO_3$ | None | 1 | 1100 | Smooth firm | Crack-free | Powdery | 1.5 | 1000 | $H_2$ |

*Deposits compacted with hydraulic pressure.
**All deposits formed on the anode.

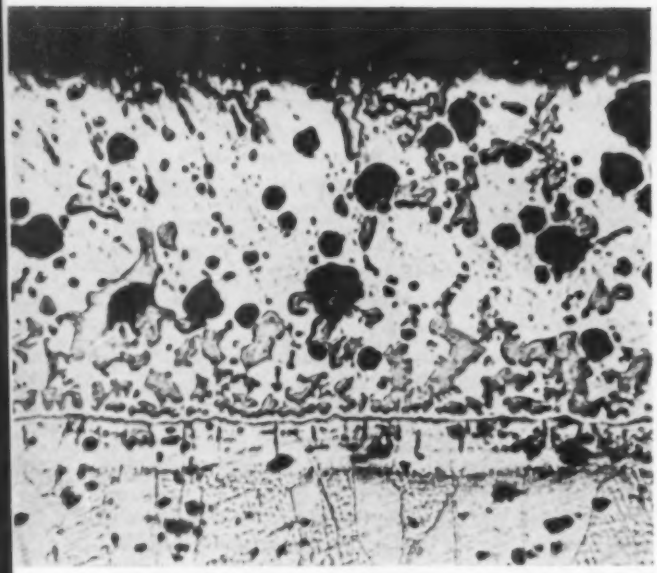

Fig. 1. Cross-section of a sintered deposit of titanium-nickel alloy (1.5 per cent Ni, magnification 250x).

Mixtures of titanium hydride with each of the above metals or their oxides were deposited, reduced, and sintered. The best result was obtained with a nickel alloy prepared from titanium hydride plus 5 per cent by weight of nickel oxide. The addition had a marked beneficial effect on the stability and depositability of the suspensions, compared with that of titanium hydride alone. No wetting agent was needed in the suspension, but 5 per cent by weight of cellulose acetate (with respect to the suspended solids) markedly improved the "green strength" of the deposits. The deposited mixture was sintered one hour at 1100C in a helium atmosphere.

A cross-section of a typical sintered deposit of the Ti-Ni alloy is shown in Fig. 1. It shows the presence of a number of spherical voids. These may be gas bubbles entrapped during sintering. They are not interconnected and therefore did not result in exposure of the basis metal. A diffusion zone between the steel and the coating is visible. Presence of the diffusion zone was confirmed by chemical analysis of a coating, which was found to contain 17.7 per cent of iron and 1.5 per cent of nickel. A mixture of titanium hydride with 5 per cent of NiO should yield an alloy with about 4 per cent of nickel. Some nickel obviously diffused into the basis steel, but one would not expect this to account for the difference between 1.5 and 4 per cent. Fractionation of the components of the suspension may have occurred during deposition.

Coatings ranging from 0.002 to 0.008 inch in thickness were prepared. Shrinkage during sintering sometimes caused the formation of a few wide cracks. In these cases there appeared to have been a pseudo-flow of the coating due to surface tension.

### B. Deposition of Other Metals and Oxides

Conditions for depositing aluminum, germanium, germanium oxide, silicon, and tungstic oxide are summarized in Table II. All of these could be deposited readily under the conditions shown, but the search for conditions for reducing and sintering the deposits that would yield sound metallic coatings was unsuccessful.

## 3. ACKNOWLEDGMENTS

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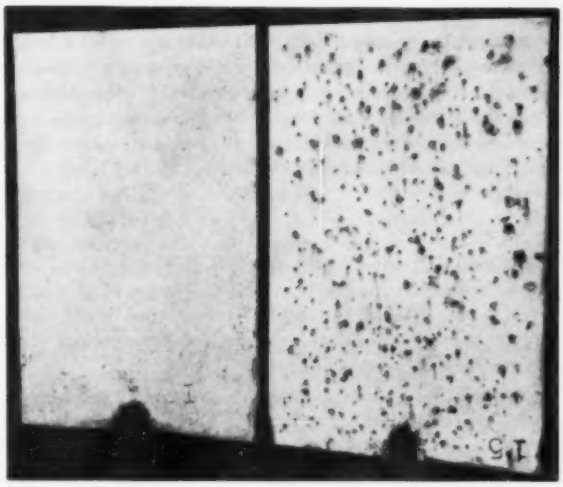

**Fig. 1.** 1.5 mils bright nickel (left) and 1.5 mils buffed Watts nickel (right) after 7-½ months exposure at Kure Beach. Both panels without chromium plate.

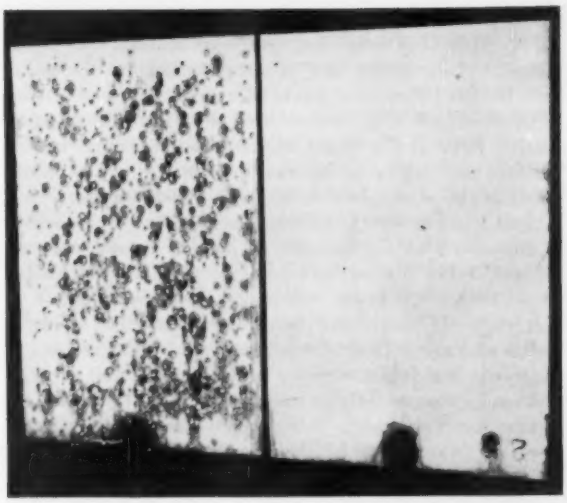

**Fig. 2.** 0.01 mil conventional chromium plate over 1.5 mils bright nickel (left) and 1.5 mils buffed Watts nickel (right) after 7-½ months exposure at Kure Beach. (These nickel base plates are replicates of those shown in Fig. 1.)

# THE CONTRIBUTION OF NICKEL AND OF CHROMIUM TO THE DURABILITY OF DECORATIVE PLATING*

by CLARENCE H. SAMPLE†

## I. INTRODUCTION

THE PURPOSE OF THIS PAPER is (a) to review some observations of the corrosion behavior of various decorative plating systems, and (b) to present some opinions as to the reasons for the behavior differences noted. It is hoped these observations and opinions will shed some light on the seemingly-confusing current situation about "how much and what kind" of nickel and of chromium should be used to provide the degree of corrosion protection and luster required; and also encourage further research efforts in those areas where a better understanding of the basic factors appears to be needed.

The material presented is not directed specifically toward zinc-base die castings. It deals with decorative nickel-chromium coatings in general and is for the most part applicable to all types of basis metals to which such coatings are commonly applied. In the case of zinc-base die-castings however, it is recognized that practically all decorative nickel-chromium coatings are applied over a preliminary copper deposit.

## II. BACKGROUND INFORMATION

Early during the exposure of the ASTM Committee B-8 Program 4 test panels at Kure Beach,** the improvement in protective value of thicker than normal chromium coatings over the bright nickel used in these tests, was clearly revealed.[1] The chromium was deposited from a conventional bath under normal conditions of operation, and from a well-known pro-

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** Marine Atmosphere Exposure Test Station of The International Nickel Company, Inc., at Kure Beach, North Carolina.

prietary bath, in thicknesses of 0.0005, 0.01, 0.03 and 0.06 mil. As expected, the two thickest chromium coatings were highly crazed. Nevertheless, and in sharp contrast to the panels with the two thinner coatings of chromium, little or no rusting of the steel basis metal was evident. In other words, the protective value of the bright nickel-heavy chromium coating systems was excellent, whereas the protective value of the bright nickel-thin chromium coating systems was very poor.

Again, and in very sharp contrast, the above noted effects of chromium coating thickness on protective value were not evident, even to a slight extent, when buffed dull nickel, rather than bright nickel, was used under the chromium. In fact, early in the exposure there was evidence that on buffed dull nickel the thinnest chromium coating (0.01 mil in this case) was, if anything, superior to the thicker chromium.

Running concurrently with the B-8 Program 4 tests at Kure Beach, were some tests[2] designed to compare the effect of applying conventional chromium, 0.01 mil thick, to three different proprietary bright nickels and to buffed dull nickel. Replicate panels were also exposed in the industrial atmosphere at Bayonne, N. J. The results of these tests demonstrated that some bright nickels are adversely affected to a significant extent, by conventional chromium plating, insofar as the protective value of the composite is concerned. This, again, is in marked contrast to the behavior of buffed dull nickel, the protective value of which is greatly enhanced by conventional chromium plating of conventional thickness. Representative panels from these tests are shown in Figs. 1 and 2. It is also pertinent to note at this point that the protective value of unbuffed Watts nickel at both Kure Beach and Bayonne is also greatly enhanced by conventional chromium plating.

It will be recalled that the first ASTM-AES specifications for decorative plating were developed largely, if not entirely, on the basis of experience with conventional chromium plating on buffed dull nickel. It is, therefore, easy to understand why 0.01 to 0.02 mil chromium was specified. This was then, and on the basis of many subsequent tests continues to be, the proper choice of chromium thickness for buffed dull nickel, to achieve the desired level of performance with maximum economy.

As indicated by the title of this paper, it is concerned essentially with the roles of nickel and chromium in the corrosion behavior of decorative plating. The relative merits of copper versus nickel in decorative plating is quite another subject, and has been dealt with previously.[3] However, the occasionally beneficial effect of an underlying layer of copper on the performance of some bright nickel-chromium coating systems[4] is of technical interest to this discussion since it contributes to an understanding of the mechanics of behavior of composite coatings. On this basis, attention is again called to the results of ASTM Committee B-8 Program 1[5] in which the marked superiority of all nickel, as opposed to combinations of copper-nickel base plates for bright chromium, was clearly demonstrated. Why is it that we have this apparent anomaly between the behavior of buffed dull nickel and some bright nickels over copper? The answer to this question appears to be intimately associated with the reasons for the beneficial effect of heavier than normal chromium on some bright nickels, as well as the detrimental effect of thin chromium. This will be discussed further in the following section.

## III. DISCUSSION

Because of the tremendous savings in time, labor and materials, as well as the significant improvements in initial appearance, that can be effected by the use of highly lustrous bright nickels, it is most unlikely that plating on a large scale will ever revert to the use of buffed dull nickel as a base for bright chromium. That brings up an important question. How can one utilize the economically and esthetically important advantages of *as-plated full brightness* while retaining the high standard for protective value established with conventional chromium-plated buffed dull nickel?

### A. Duplex Nickel

Fortunately, the industry now has a practical and field proven answer to this question. This is the use of a "double-layer" combination of (1) highly leveling, semi-bright nickel and (2) fully bright nickel as a base for conventional chromium of conventional thickness.

This coating system is variously referred to as "duplex nickel". The advantages of a double layer of nickel under conventional chromium were demonstrated by Exposure Test Program 1 of ASTM Committee B-8. Many more recent tests[6] have clearly shown that a "duplex" combination of high leveling, semi-bright and fully-bright nickel will produce excellent results. When applied in sufficient total thickness, such a "duplex" combination, including the normal thickness of conventional chromium, will achieve a level of protection substantially equivalent to that provided by chromium-plated buffed dull nickel of the same thickness.

In this system full advantage is taken of the good corrosion resistance, leveling characteristics, and ductility of semi-bright nickel plus the brilliant luster of leveling, fully-bright nickel. The principal contribution of the bright nickel layer, is to provide the required luster at minimum cost. In addition to its advantage for smoothing the surface, the underlying semi-bright layer is primarily responsible for the lasting corrosion protection to the basis metal. For this reason, the ratio of the thickness of bright to semi-bright nickel is controlled to the most practicable minimum to achieve the required initial appearance of the plated product.

Perhaps most important of all, especially from the point of view of economy, conventional bright chromium of conventional thickness is quite satisfactory for a final coating on duplex nickel. That is, the additional power, space, facilities, and time required to apply "heavy chromium" (3 to 10 times conventional thickness) are not required.

### B. "Heavy Chromium" over Bright Nickel

The improvement in the performance of the heavier-than-normal chromium coatings over the bright nickel of ASTM B-8 Program 4 was pointed out earlier. Such coatings, however, are not acceptable appearance-wise because of the crazing of the thicker chromium.

For this reason attention has been given to the practicability of applying heavy, bright, crack-free chromium. Promising results have been reported by several investigators.[7] It would appear, however, that it is difficult, if not impossible to achieve or to assure complete freedom from cracking of heavy chromium on all the critical areas of commercial items, especially those of complex shape. Further, in some instances it has been found that even though heavy chromium coatings of this sort are apparently crack-free initially, they can not be depended upon to remain so even for a few weeks in storage.

In any event, the emphasis on a "heavy, bright, crack-free" approach seems to have given way to interest in "duplex chromium" the top layer of which shows a complete maze of exceedingly fine, interconnected, short cracks. Presumably,

the very close spacing of these cracks minimizes or may even prevent the formation of the usual, much wider, craze cracks of heavier than normal conventional chromium. It has been postulated that the fineness of the crack pattern acts to distribute galvanic corrosion of the nickel over a much larger anode area, and thus minimizes intense local attack with subsequent perforation of the nickel.[8] This may be a factor, but there is also a possibility that the extreme narrowness of such cracks actually impedes galvanic corrosion as a result of increased cell resistance due in turn, to the minute cross-section of electrolyte or to actual plugging of the crack with corrosion products.

Very promising results and interesting claims have been reported for this type of chromium over bright nickel. The appraisal of the merit of duplex chromium, however, has been based so far largely on the results of recently developed accelerated corrosion tests. Since the reliability of these tests and their correlation with service performance have not yet been established with certainty, more service experience will be needed before this practice can be assessed relative to other more established means of securing the desired result.

Thus, much remains to be learned about these newer decorative plating systems involving heavier than normal chromium. Toward this end, Subcommittee II of ASTM Committee B-8 has recently initiated a new exposure test program which includes a variety of chromium coatings over duplex nickel. It may be found that duplex chromium over duplex nickel will prove to be a much superior coating combination, performance-wise, than anything the industry has used up to this time.

It is well known that chromium is highly resistant to corrosion in all types of atmospheric environments to which decorative plating is normally exposed. Also it is possible that chromium coatings of only a few millionths of an inch thickness which are completely continuous, (i.e. non-porous or at least effectively impermeable to atmospheric corrodants) will provide lasting protection to substrate metals even in very corrosive locations such as Kure Beach, and Pittsburgh. In other words, if it were possible to provide consistently pore-free chromium coatings which would remain so during the expected life of the plated part there would be no need for substrate coatings insofar as corrosion protection of the basis metal is concerned. Practically, however, a goal of using chromium without the benefit of a nickel substrate coating does not appear likely of attainment.

Further, due to the brittleness and fragility of thin layers of electrodeposited chromium, it is unlikely that such deposits, even though initially continuous, would remain so when subjected to the normal conditions of abrasion, impact and wear to which such items as automobile bumpers and trim are exposed. Thus, the practical necessity for a physically durable, inexpensive and corrosion resistant base coating for decorative chromium is readily recognized. In addition to providing insurance against basis metal corrosion at breaks in the chromium, highly leveling substrate coatings can also serve to minimize basis metal polishing costs. Electrodeposited nickel, is the ideal metal to fill this role because of its favorable mechanical properties, its ready reception of chromium plating and its good resistance to corrosion.

### C. Why Coatings Behave as They Do

A review of the recent literature leaves no doubt that the former "comfortable unanimity of opinion" as to the cause of poor performance of decorative chromium coatings[9] has again given way to uncertainty and confusion—not only as to the cause of failure but also and more particularly, the remedy.

Some have suggested that increased corrosivity of the environments to which the decorative plating on automobiles is exposed, could account for the poorer performance in recent years as compared to several years past.[10] Perhaps this is a factor, but it obviously cannot account for the great differences in behavior noted between chromium plated buffed Watts and bright nickel plated panels exposed simultaneously at Kure Beach (and elsewhere). Nor can it account for the variable behavior of some bright nickel-chromium coated panels (and production parts) plated simultaneously on the same rack and exposed at the same time to the same environments.

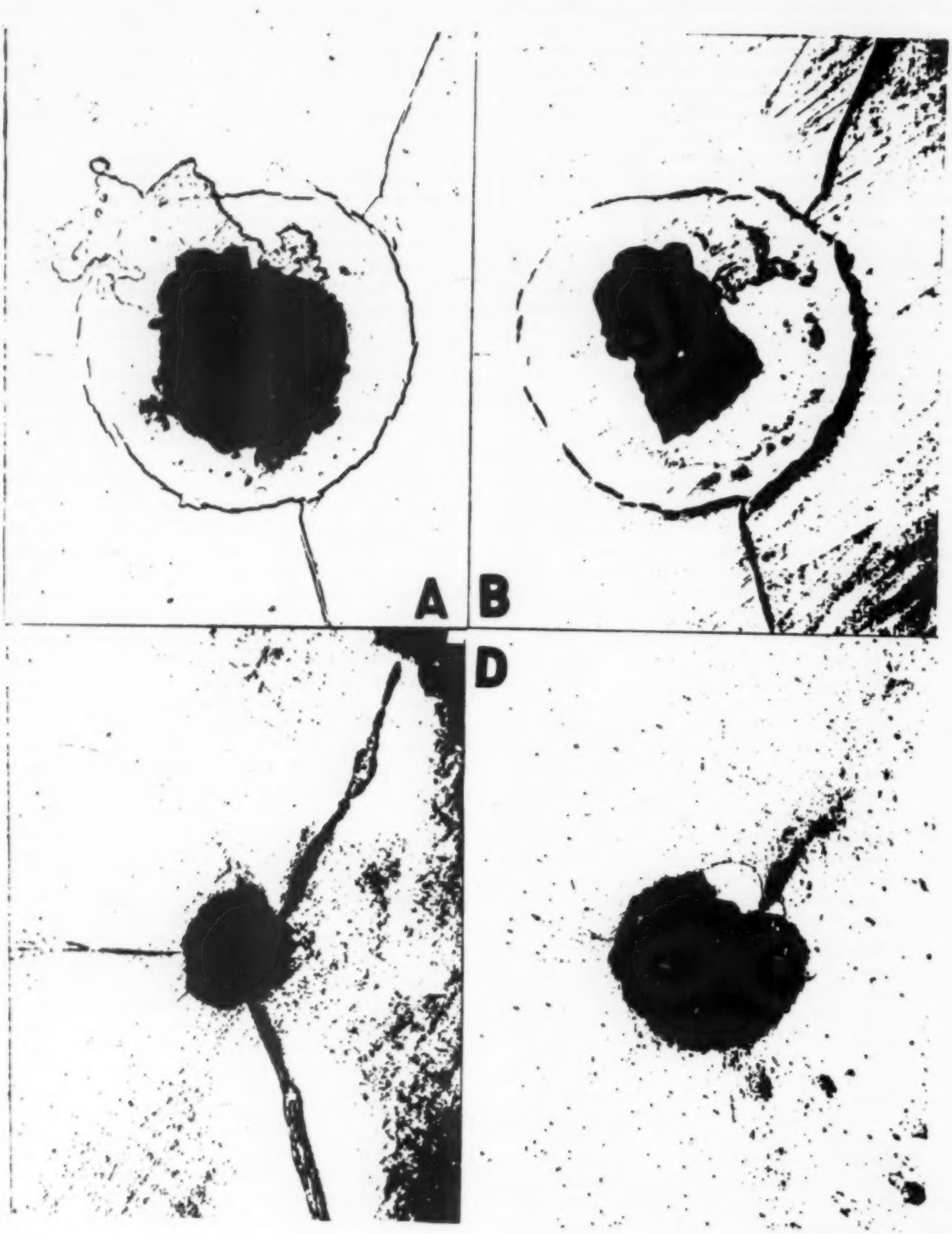
Others have blamed a very unfavorable (but mostly assumed) E.M.F. relationship between nickel and chromium, emphasizing the additional unfavorable aspects of a large chromium cathode and a minute nickel anode.[9, 11] Undoubtedly, pitting of the nickel, accelerated by deicing salts and perhaps increased galvanically by the presence of the chromium are factors. Also, in this connection there is good evidence that nickel deposits containing sulphur are chemically more active (less noble) than those which do not. It is doubtful, however, that these are the primary reasons for the wide spread variability and in some cases relatively poor performance of bright nickel-chromium plating of recent years.

Why is it that heavier than normal chromium so markedly improves the performance of those bright nickels which apparently are adversely affected by chromium coatings of conventional thickness?

The answer to this question would seem to be found in the unique physical nature and characteristics of bright nickel deposits, together with the recognized superb "micro-throwing power" of chromium plating solutions (and perhaps their corrosivity). In sharp contrast to Watts-type nickel deposits, modern "organic" bright nickels are exceedingly fine grained. In fact, recent work[12] has indicated that the crystallites of such deposits are so minute that observation of their individuality and the detailed structure of the deposit, taxes the resolving power even of the electron microscope. In addition, X-ray diffraction studies have provided significant evidence of considerable "micro-stress" within the crystallites. Apparently, such stresses may exist even though "macro-stress" measurements may indicate low tensile or even compressive stress in the deposit as a whole.

What is the effect of chromium plating onto an exceedingly fine grained, hard, micro-stressed material of this sort? It is doubtful that anyone knows for sure at this time. There is, however, evidence that cracking of fine grained bright nickel is promoted by some aspect of chromium plating.[13] Further there is evidence that the type of cracks involved here are quite unusual. They are very, very narrow relative to the cracks associated with the more familiar crazing of some bright nickel-chromium combinations and the usual cracks in heavier than normal, conventional chromium. In some instances, many very minute, circular cracks have been observed. A typical example of this is shown in Fig. 3. Also, many of these and other cracks appear to be so fine (narrow) that even though they extended through to the basis metal no corrosion of the latter occurred during nine months exposure at Kure Beach and Bayonne.

It could well be that such cracks are just too fine to permit the normal pinhole-type corrosion process to proceed. It is conceivable that such fine cracks could in effect become plugged with corrosion products more or less immediately and as a result, further action is effectively stifled. On the other




(Magnification 200X)

**Fig. 3.** Parallel section photomicrograph series of circular shaped crack in bright nickel-chromium plated steel panel after 9 months exposure at Bayonne, N. J. A. The top chromium surface; B. Chromium layer just removed; C. The nickel coating about to be removed, the basis metal can be seen at some spots along the cracks; D. Nickel completely removed and a slight indication of corrosion at the base of the top right crack. (This is a reproduction of Fig. 8 of reference 13.)

hand, at the intersection of two or more such cracks, one might reasonably expect the opening to be wider. And, there is some evidence that it is at just such points where the observed early rusting of bright nickel-chromium plated steel at Kure Beach occurs and where surface pitting (which may eventually take the form of "crow's feet", "stars" etc.) is initiated in industrial atmospheres. Unfortunately, after corrosion of these types has proceeded for some time, the evidence as to the original cause of the action has been destroyed. In this connection it would appear that a thorough, highpower microscopic examination of the surface of suitable plated specimens before and during the *very early* stages of exposure would be fruitful. Considering the minuteness of the defects and the magnification required to detect them, it is impracticable to undertake such work on the usual 4" x 6" panel used for exposure test studies. The minuteness of defects of this sort may also account for the reason why many careful observers have not detected "pin-holes" in the usual metallographic cross-sections of electrodeposits. Such defects are, however, subject to study, though not readily or easily, by means of the "parallel polishing technique" employed by Dr. D.W. Ernst in his work on AES Research Project 13 at the National Bureau of Standards.

In connection with cracking of bright nickel as a result of chromium plating it is pertinent to note that other materials may also be adversely affected. For example, chromium plated electroless nickel coated steel panels exposed at Kure Beach exhibited very early rusting through what appeared to be a maze of very fine cracks, whereas similar panels without chromium did not. On the other hand chromium plating was found to have no adverse effect whatsoever on electroless nickel coated steel which had been heat treated to effect crystal growth of the coating. The high hardness and exceedingly fine grain structure (if indeed any) of as deposited electroless nickel are well known. Further, recent studies have indicated that a high order of micro-stress may exist in as deposited electroless nickel and that these stresses are relieved when the coating is heat treated to effect course crystal growth.[14] Thus it seems most likely that the adverse effect of chromium plating exceedingly fine grained bright nickel and as deposited electroless nickel are related phenomena, if not due to the same, as yet obscure, causes.

Further along these lines it is also of interest to note that bright nickel plated steel panels which were plated in conventional chromium plating bath at 120F have exhibited good corrosion resistance for about 17 months at Kure Beach. Whereas, replicate panels, except those chromium plated in a conventional bath operated at 120F were noticeably affected within a few weeks. This, of course, suggests greater corrosivity of the high temperature solution, as might be expected.

All of the above, together with the fact that thicker than normal chromium coatings (e.g. 0.03 mil and above) over bright nickel exhibit much improved protective value, leads to the following hypothesis of the mechanisms involved.

Hard, exceedingly fine grained (and perhaps micro-stressed) nickel coatings are prone to fine cracking when they are chromium plated. It would appear that such cracking occurs during the very first moments of the operation. The mechanism of the cracking phenomenon, while presently obscure, is probably either some sort of stress corrosion cracking, or, so called hydrogen cracking, or perhaps a combination of both.

Due to the very fine nature of the cracks involved, together with the excellent micro-throwing power of chromium plating solutions, such cracks and their intersections are in effect, filled or bridged over with chromium when chromium plating is continued beyond the time required to apply conventional thicknesses (e.g. 0.02 mil or less). Thus, in effect such coatings are substantially pore-free initially and as a result do not exhibit rapid failure. With conventional chromium plating thicknesses, however, only the very finest cracks apparently are bridged or sealed, but the wider cracks and intersections of two or more are not. Thus such coatings are not pore-free initially and as a result exhibit early failures in environments such as at Kure Beach.

In connection with rapid failure at Kure Beach, it should be pointed out that the weather conditions there during much of the year appear to be particularly favorable for detecting discontinuities in such finishes as nickel and nickel-chromium coatings on steel. Heating and drying by hot sunshine during the day followed by cooling and dew formation at night, in the constant presence of chlorides derived from sea water mist, seems to result in a very sensitive porosity test. The detection of initial porosity, rather than the creation of pores as a result of corrosion from the outside, in, seems most likely, especially since the corrosion rate of nickel (and of chromium) under these conditions is practically nil.

The above hypothesis of the cracking of bright nickels as a result of chromium plating can account not only for the relatively poor performance of some decorative coating systems but also for the extreme variability in performance noted on several occasions. Specific plating conditions at various points on an irregularly shaped article (or on a flat panel for that matter) cannot possibly be exactly the same. Current density, degree of agitation and most likely polarization vary considerably at different points on the surface of an article being electroplated. Hence it is reasonable to expect that with bright nickel deposits, grain size, micro-stress and the resulting susceptibility to cracking by chromium plating, could vary correspondingly.

### D. Copper-Nickel Versus All Nickel

As indicated earlier, in the case of some bright nickels there is ample evidence to support the view that undercoatings of copper are beneficial. In fact, the evidence indicates that with some bright nickels, over-all corrosion protection improves as the ratio of copper to nickel thickness under chromium is increased. While this observation is diametrically opposed to the conclusions drawn from earlier work, it is nevertheless logical and easily understandable in view of the poor performance of some bright nickel-chromium combinations applied directly to steel.

It is to be expected that any reasonable replacement for a major portion of a form of bright nickel which is not able to contribute much to overall protection, would result in improved performance. Where a layer of copper is used as the replacement, it serves as a temporary barrier, to prevent corrodants from reaching the steel through the unique, fine cracks that develop in nickel of a type susceptible to such cracking when chromium plated. As might be expected, the thicker the copper the longer the time before the corrodants reach the basis metal.

At this point, however, it must be emphasized that even the best of coatings of the above sort are far below the level of durability contemplated when ASTM Specifications A166, B141 and B142 were written. They are also far below the high level of protective value attainable with nickel-chromium coatings applied directly to steel, as demonstrated in ASTM Committee B-8 Exposure Test Program No. 1.

In other words the unquestionable "improved" performance

of certain copper-bright nickel-chromium, versus certain straight bright nickel-chromium coatings, reported since publication of the B-8 Program 1 results involving buffed dull nickel, is meaningful only in the sense that the one system is better than the other even though both are unsatisfactory for the intended application. That is, while the results of the referenced investigations are entirely valid in themselves, and thus appear to contradict the B-8 Program 1 findings, they actually do not conflict, because of the great differences in the nature of the nickel coatings in the several programs. These variations resulted in such changes in the level of performance as to make the apparent contradiction meaningless from the practical point of view.

## IV. Summary of Conclusions

1.) From the standpoint of protecting the basis metal against corrosion, recent experience has shown that fully bright nickel is more variable and generally inferior to buffed dull nickel of the same thickness, when plated with conventional chromium of conventional thickness.

2.) "Duplex" nickel coatings when plated with conventional chromium of conventional thickness provide basis metal corrosion protection substantially equivalent to that of chromium plated buffed dull nickel of the same thickness.

3.) The application of "heavier than normal" chromium coatings to those bright nickels which are adversely affected by conventional chromium plating, markedly improves the protective value of the combination. However, since such coatings systems are relatively new, further experience with them will be required to establish their advantage over an improved nickel substrate from the points of view of relative economy and long term durability.

4.) Combination copper-bright nickel-conventional chromium coatings may exhibit better protective value for a limited time than comparable coatings without copper but even at best such coatings fall far short of the high standards of durability established in the industry years ago with buffed dull nickel- conventional chromium and now available with duplex nickel systems.

5.) As a result of vigorous, industry-wide research and development efforts, particularly in the area of accelerated corrosion testing, the general quality level of decorative nickel-chromium plating has improved very appreciably during the past year or so. Further marked improvements can be expected with confidence, as additional knowledge is gained from investigations currently underway and the research which will be done in the future.

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He received a BS in Chemical Engineering in 1930 from the University of Idaho and was awarded his MA in Physical Chemistry by Columbia University in 1938.

As a member of the Technical Staff, Bell Telephone Laboratories, N. Y. from 1930–1945, he was engaged in research and development work on corrosion protection and metal finishing. Mr. Sample was chief engineer, Rheem Research Products, Baltimore, Md., from 1945 to 1946 when he joined International Nickel Co.

He has been chairman of ASTM Committee B-8 on Electrodeposited Coatings from 1947 to date and was secretary of the Committee from 1943 to 1947. He is a member of the Electrochemical Society, American Electroplaters' Society, American Society for Metals, National Association of Corrosion Engineers, American Association for the Advancement of Science, American Chemical Society.

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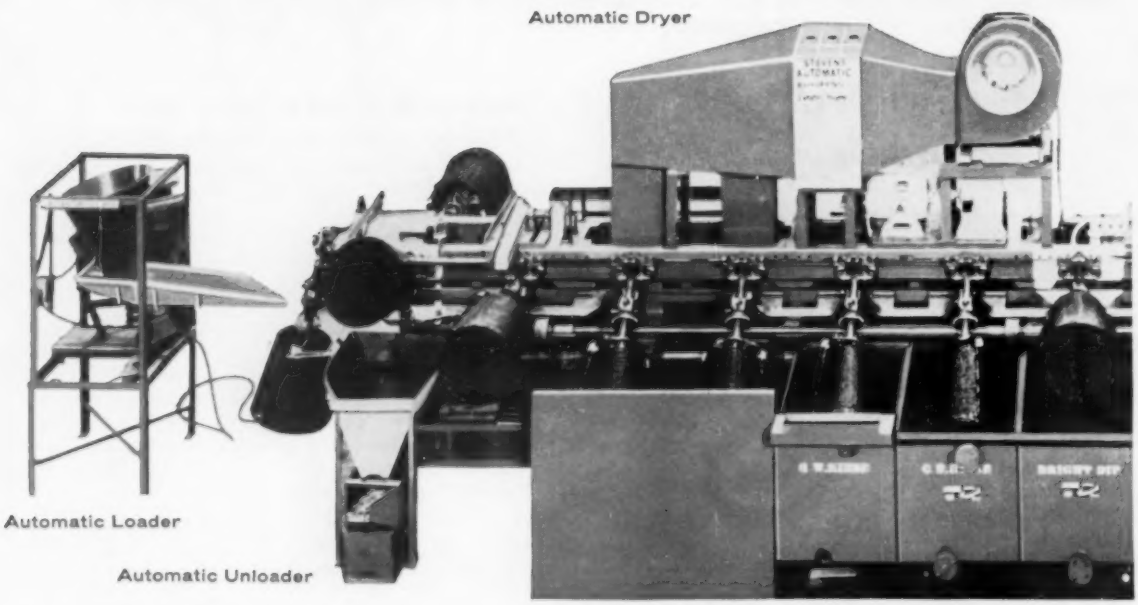


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## MIDWEST REGIONAL COUNCIL IN WINTER MEETING

The Midwest Regional Council, six Branch strong, held its Winter Meeting at the Conrad Hilton Hotel, Chicago, Saturday, January 30, with Chairman Leslie L. Diveley presiding, and cleaned up a challenging agenda. All Officers of the Council were reelected, including Mr. Diveley (Milwaukee) as head; Gene Roth (St. Joseph Valley) as Vice Chairman and Paul Glab (Chicago) as Secretary-Treasurer. Composed of the Chicago, Milwaukee, Mississippi Valley, Rockford, St. Joseph Valley and St. Louis Branches, the region is now operating under Regional Bylaws, consonent with the AES Constitution and Bylaws, recently unanimously passed by all signatory Branches.

This AES regional council that will sponsor the AES's 49th Annual Convention to be held at the Schroeder Hotel, Milwaukee in 1962, with the Milwaukee Branch as host has progressed in its planning to such an extent under Convention General Chairman Herman A. Tessmann, that the Convention Committee will hold its organizational meeting concurrently with the Milwaukee Annual Meeting, April 29–30.

The Council named the St. Joseph Valley Branch as host of the Region's next Annual Educational Sessions. It also demonstrated its wholehearted cooperation with the Societywide maximum effort to expand the AES's Sustaining Membership ranks by naming George Parisho (Mississippi Valley Branch) as Regional Research Finance Chairman under the Vice Chairman of Finance of the National AES Research Committee.

Those present at the January 30 meeting included, besides the aforementioned officers, Dr. Russel E. Harr, Clyde Kelly and R. Scott Modjeska (Chicago); Herman A. Tessmann, Ted L. Sobczynski, Sylvester R. Taterzynski, Frank H. Marshall and Henry Bornitzki (Milwaukee); Lloyd O. Gilbert and George Parisho (Mississippi Valley); William C. Geissman, Harold Ellis and Murray E. Rounds (Rockford); Ralph D. Wysong and Ralph Brouwer (St. Joseph Valley); A. P. Julius and William George (St. Louis).

**The Midwest Regional Council in session at the Conrad Hilton Hotel in Chicago. All six member AES Branches were represented. Chairman Leslie L. Diveley at head of table.**

**Around the clock at the Chicago Annual Meeting, January 30. (Top left) A view of the Udylite Luncheon. (Top right) Stalwarts of the Educational Session. (Bottom left) The Cocktail Party sponsored by 52 suppliers. (Bottom right) The memorable Chicago Banquet.**

## CHICAGO BRANCH STAGES EDUCATIONAL SESSION ATTENDED BY RECORD AUDIENCE

As audience for one of the most prominent panels of plating and metal finishing experts of the 1959–1960 AES educational season, a record assembly of nearly 300 members and guests of the Society's Chicago Branch attended the Annual Educational Sessions of that dynamic Branch held at the Conrad Hilton Hotel, Chicago, Saturday, January 30.

Under the theme of "New Plating Specifications and Test Methods", and with National AES President Ralph D. Wysong himself presiding, that audience heard Past AES President Cleveland F. Nixon, General Motors Corporation and Joseph T. Gurski, Ford Motor Company, discuss various phases of the symposium subject relating to the automotive industry. Leonard P. Weeg, National Lock Company, concentrated upon the appliance and other industries.

Chicago Branch's Annual Meeting day continued with an enjoyable joint cocktail party hosted by 52 industrial companies of the Chicago area—and concluded with a Banquet, floor show and dance that delighted the nearly 850 AES members, their families and their guests present. The lavish floor show was among the best of the current Branch season.

The traditional Chicago Branch Annual Meeting also provided opportunity for a number of other events, including 1) the full-day's meeting of the AES Editorial Board held the prior day; 2) the meeting of the Midwest Regional Council held Saturday forenoon; 3) the meeting of the Board of Trustees of the Metal Finishing Suppliers Association (MFSA), and the traditional Annual Cocktail Party and Luncheon sponsored by the Udylite Corporation.

At the latter event attended by over 200 guests of the Udylite Corporation and titled "Around the World in 40 Years," Board Chairman L. K. "Lindy" Lindahl presented an illustrated talk of his world trip, accompanied by Dr. Henry Brown, Udylite's Research Director, not only visiting that company's friends and distributors in numerous countries but also enhancing world technical and scientific education on electroplating, metal finishing and allied arts.

# AES NEWS

## POST-GOLDEN JUBILEE MAILING INSPIRING INTEREST IN AES

Several thousand AES non-members interested in education in electroplating, metal finishing and allied arts attended the GOLDEN JUBILEE Convention or the Fifth Industrial Finishing Exposition or the International Conference on Electrodeposition and Metal Finishing concurrently held by AES in Detroit June 15–19, 1959, climax of the Society's Fiftieth Anniversary year.

To each of these non-members has now gone not only a reprint of the eight-page day-by-day summary of the GOLDEN Jubilee Convention originally carried in the August 1959 issue of PLATING MAGAzine, but also a Return Sheet enabling each of these individuals to procure membership information concerning the Society and its standards of membership eligibility if interested. The returns from such individuals for such AES membership information has been noteworthy.

### TO AES MEMBERS

**Each AES member is urged to purchase an official AES lapel pin from his Branch Secretary and proudly wear it. Branch Secretaries may, in turn, purchase such silver pins from AES National Headquarters at the following prices, including tax: Branch Past President's pin, $1.43 per pin, Branch Members pin, $1.38 per pin.**

## PRESIDENT'S CONFERENCE TO HAVE AES REPRESENTATION

The President's Conference on Occupational Safety to be held in Washington, D. C. March 1–3, 1960 will bring together in the nation's capital, leaders from American industry, labor, government, education and other facets of American enterprise personally invited by President Eisenhower. John P. Nichols, National Executive Secretary of American Electroplaters' Society, Inc. and publisher of its PLATING MAGAZINE will attend by such invitation. Secretary of Labor James P. Mitchell will serve as General Chairman with the President himself addressing the plenary session at noon of March 1.

The Washington meeting will come to grips with the knotty problem of how to minimize the country's losses in manpower, in technical skill, human suffering and financial waste that job accidents are causing. Delegates will examine problems arising out of new and intensified safety and health hazards throughout the United States economy.

## EDITORIAL BOARD PERFECTS AND FREEZES LOS ANGELES CONVENTION EDUCATIONAL SESSIONS

At its meeting held at the Conrad Hilton Hotel, Chicago, January 29, the AES's Editorial Board perfected plans and program of the Educational Sessions of the 47th Annual Convention of the Society to be held in Los Angeles July 24–28, 1960, with the AES's Los Angeles Branch as Host. As perfected, that program will include 33 papers grouped into nine sessions. Chairman John P. Nichols presided.

The Editorial Board, at its September 18, 1959 meeting, had tentatively accepted 37 papers proposed by the Host Branch Educational Sessions Committee headed by Earl W. Arnold. At that meeting, the Board authorized the preparation of final abstracts for consideration at its January 29 meeting. Those abstracts were read by Mr. Arnold to the Board at the Chicago meeting. The Board, consequently, selected 33 papers by abstract, froze the program at that number and authorized those papers to be finalized for Board final approval at its next meeting. If any fail then to pass, they will not be replaced. A Board reviewer was appointed by the Chairman for each paper.

The nine sessions as perfected subject to final paper approval at the Board's April meeting include eight that will compose the Los Angeles Convention's "Hydrogen Embrittlement in Metal Finishing Symposium." They include a three-paper session on the subject of organic coating. The program also includes a summary of AES Research Projects currently operative to be presented by AES Research Committee Chairman James D. Thomas. It includes the widely anticipated Opening Session at which Dr. A. Kenneth Graham, second winner of the "AES Scientific Achievement Award," will deliver the second "William Blum Lecture." The 33 papers are identified by title and session in the Tentative Convention Program appearing on pages 314 and 315 of this issue of PLATING MAGAZINE.

The Editorial Board also selected nine Sessions Chairmen to be invited to serve in that capacity, with four supernumeraries also named. The Chairman of the Opening Session will be the eminent Dr. William Blum, first winner of the "AES Scientific Achievement Award," the Society's highest scientific honor.

Present by invitation at the meeting was George J. Marotta, newly appointed Host Branch Educational Sessions Chairman of the 48th Annual Convention of the Society that will be held in Boston June 1961. The Board reviewed his preliminary plans. That program will feature a symposium either on "Finishing on Aluminum" or "Finishing on Light Alloys."

The Board's next meeting will be held at the Sheraton-Gibson Hotel, Cincinnati, Ohio, Friday, April 22, the day prior to the Tri-State Regional meeting that will be held at the same site.

The Hydrogen Embrittlement Symposium is being spearheaded for the Editorial Board and the Host Branch Educational Sessions Committee by Dr. Harold J. Read, Professor of Physical Metallurgy, The Pennsylvania State University. After the delivered hydrogen embrittlement papers have first been published in the AES book, TECHNICAL PROCEEDINGS (1960 Edition), they will then be included in an AES book to be published on that subject by the Reinhold Publishing Company, with Dr. Read as AES Editor.

Present at the meeting beside Chairman Nichols and Secretary Rodney Leeds were Earl W. Arnold, Robert A. Ehrhardt, Dr. Henry L. Kellner, James H. Lindsay, Dr. Abraham M. Max, Dr. Joseph V. Petrocelli, William H. Safranek, Dr. Edward B. Saubestre and Ralph D. Wysong.

**The Editorial Board hears Earl W. Arnold read final abstracts of papers for Los Angeles Convention.**

## DYNAMIC BRANCH TEAMS STIMULATING AES SUSTAINING MEMBER INCREASES

The vital Research Program of AES is financed not only through a share of Per Capita Taxes annually paid by AES Branches and a share of the annual dues of Members-at-Large, but mainly from the dues of Sustaining Members paid yearly by the many prominent industrial companies coast to coast supporting Sustaining Memberships so as to help stimulate advancements in electroplating, metal finishing and allied arts through such cooperative research.

For the consequent benefit of the Research Program, more and more AES Branches are doing effective work in stimulating increases in the Sustaining Membership ranks of the Society by inspiring industrial companies to apply for Sustaining Membership.

An outstanding example is the Detroit Branch which, under Branch Research Finance Chairman Edward J. Kubis, has several dynamic teams of "go-getters" actively working in the field inspiring industrial companies concerned with technical and scientific progress of plating and metal finishing to enter the Society's family of Sustaining Members.

Among these, the Detroit team of Jack Kershaw and Harold Kahler alone has inspired at least four such Sustaining Member applications within three months, closely followed by the team of Glenn Friedt Jr. and William P. Kotke. Other Branches that are following substantially similar procedure with effective result to date are Grand Rapids, Los Angeles, Indianapolis and Waterbury.

## BRANCH BYLAWS REQUIRE LAW COMMITTEE CERTIFICATION

All 58 AES chartered Branches are reminded that Branch Bylaws, or amendments thereof, require certification from the Law Committee of the National Society before becoming official and operative upon Branch enactment. Under Part I, Article III, Section 3 of AES Bylaws, the Law Committee is required to:

> ". . . . examine all new rules and laws of the several Branches and Standing Committees, and any amendments thereof, for inconsistencies with the laws of the Society and shall certify those found free of such inconsistencies."

Consequently, if and when you may create new or amended Branch Bylaws, send a complete copy of that instrument to the National Executive Secretary for channeling to the Law Committee for the foregoing action. The Law Committee is headed by Manson Glover (Boston Branch) and includes Past President William J. Neill (Columbus Branch) and Myron B. Diggin (Newark Branch).

After Law Committee certification, then Branch enactment, those Bylaws have force and effect. A copy thereof should, of course, then be submitted to National Headquarters for its permanent files.

## WESLEY TO INSTALL BUFFALO BRANCH'S NEW OFFICERS

AES's Buffalo Branch will conduct its Annual Meeting at the Niagara Manor in Buffalo on May 6. Aside from other features, the Branch will honor all of its Branch Past Presidents and present each with an AES Branch Past President's Pin.

AES First Vice President W. Andrew Wesley will be the honored guest and principal speaker. He will install the Branch's new officers and explain to each his duties and responsibilities.

The Buffalo Branch, moreover, is sponsoring a booth at the Industrial and Engineering Fair of the Technical Sessions Council to be held April 19–21, 1960 at the Buffalo Memorial Auditorium. By this booth, Buffalo hopes to increase interest in electroplating in its area and, through this, gain new members for AES.

## MAIL YOUR CONVENTION RESERVATION FORM EARLY

An envelope carrying information concerning AES's 47th Annual Convention to be held in Los Angeles, California, July 24–28, 1960, including a Hotel Reservation Form, was issued by AES National Headquarters to each AES member in good standing, regardless of membership classification, early in February in behalf of the Los Angeles Convention Committee headed by General Chairman Tony Stabile.

The Hotel Form is also being carried in this issue of PLATING MAGAZINE for the further convenience of AES members. You are urged to accomplish and mail yours as promptly as possible to be sure of early processing in Los Angeles.

## PHOENIX BRANCH SPONSORING A SYMPOSIUM AND EXHIBITION

The new Phoenix Branch of AES will conduct its First Arizona Metal Finishing Symposium and Industrial Exhibition on Saturday, March 26, 1960. Under the leadership of Paul Wible, General Chairman, the event will be staged at Arizona State University, Phoenix.

"Engineering, production and associated personnel in Arizona's fast growing industrial field," says Mr. Wible, "will greatly benefit from the educational sessions on modern finishing procedures, techniques and processes. The industrial exhibits will provide highly interesting displays by our many facilities throughout the State."

## TO ALL BRANCH SECRETARIES

1. **Your Branch President and you as Branch Secretary have now received from National Headquarters, your Branch's Return Sheet through which your Branch can nominate any qualified member in good standing whom it pleases for the 1960 CHARLES HENRY PROCTOR MEMORIAL LEADERSHIP AWARD, the AES's highest non-technical, non-scientific honor. That Return Sheet, properly signed by your Branch President and by yourself, should be in the hands of the National Executive Secretary by or before April 1, 1960 for consideration by the Award's Selection Committee for this year's Award. Your Return Sheet, to be acceptable to the Selection Committee, must be accompanied by SEVEN copies of a statement of accomplishments of your nominee buttressing his nomination.**

2. **Your Branch has received from National Headquarters, a quantity of a two-color, accordion-fold combination AES membership promotion piece and Application Blank. Initiated by the National Membership Committee and prepared by Headquarters, these leaflets are intended to assist your Branch to increase its membership. The new item does not replace "AES Membership: Its Meaning to YOU" so successfully being used by National Headquarters in answering membership inquiries, particularly for Membership-at-Large. It supplements it.**

3. **Many Branches have accepted the Public Relations Committee's recommendation and are distributing copies of the vaunted booklet, "MILESTONES OF AES," among their new members. Reasonable quantities are still procurable from Headquarters without charge for Branch use for such purpose.**

## MILWAUKEE READYING ANNUAL MEETING

Milwaukee Branch has announced that its annual educational session and banquet will be held at the Hotel Schroeder in Milwaukee, on Saturday, April 30.

A luncheon has been scheduled for 12 noon. The educational session will start at 1:15 p.m. Lloyd Gilbert of Rock Island Arsenal is to be the speaker. His topic will be "How Design Influences Finishing" or "Things that Shouldn't Happen to a Metal Finisher." Mr. Gilbert is a founder and past president of the AES Mississippi Valley Branch. He has appeared before many AES Branches and several AES National Conventions.

The afternoon meeting will also feature a work session on metal finishing problems. The banquet and entertainment will be at seven o'clock.

Tickets may be ordered from the chairman in charge, Fred Anderson, S. K. Williams Co., 2370 North 32nd Street, Milwaukee 10, Wisconsin.

The AES 49th Annual Convention Committee will hold its organizational meeting concurrently with the Milwaukee Annual Meeting.

## AES THANKS . . .

A special Branch contribution to the AES Research Program in the amount of $100 for 1959–1960 was recently received at National Headquarters from the Detroit Branch of the Society. AES and its Research Committee express hearty thanks.

## THIRD VICE PRESIDENT MEETS WITH MONTREAL

Manuel Ben of the General Motors Company and AES Third Vice President was the principal speaker at the Educational Session of the Society's Montreal Branch held in that city, January 11. He presented an illustrated technical talk, then also discussed AES national affairs.

*Photographs Courtesy of F. L. Conlan, Hialeah, Florida*

**(Left) Dixie Regional Technical Speakers. Left to right, top row, Al Korbelak, Dr. Henry Kellner; bottom row, Bruce E. Scott, Dr. E. J. Seyb. (Right) View of part of the audience at Educational Session.**

## SUCCESSFUL DIXIE REGIONAL MEETING IN TROPICAL MIAMI

Registering a record attendance of AES members, their families and their guests hailing not only from Dixie but also from many distant Northern and Western points, the AES's two-day Second Annual Dixie Regional Educational Meeting held January 15–16, 1960 under ideal tropical weather conditions at the handsome oceanfront Saxony Hotel in Miami Beach, Florida, was, in every respect, a successful AES educational enterprise, a distinct credit to the Miami Branch, the meeting's host, and to the Southeastern and Blue Ridge Branches also composing that surging Region.

Welcomed to the Beach by City Manager Morris Lipp who, in behalf of Mayor D. Lee Powell, presented "Keys to the City" to National President Ralph D. Wysong, National Executive Secretary John P. Nichols, Miami Branch President Ernest Owens, General Chairman Marmaduke H. Dent and other Miami Branch leaders, the Opening Session was launched on Friday, January 15 with an invocation pronounced by Rabbi N. N. Lipshitz.

With W. J. Donnelly presiding, the Friday Educational Session featured, "Studies of Duplex Nickel Plating" by Dr. M. M. Beckwith, the Harshaw Chemical Company; "Direct Nickel Plating of Hardenable Stainless Steels" by Bruce E. Scott, Curtiss-Wright Corporation, and "Aluminum Etching and Processing" by Dr. Sam Spring, Kelite Corporation.

The Second Educational Session, held Saturday, January 16, embodied, in the order of presentation, "Jet Age Precious Metal Plating" by A. Korbelak, Sel-Rex Corporation; "The Role of Chromium for Improved Appearance and Protection" by Dr. E. J. Seyb, Metal & Thermit Corporation and "Recent Advances in Polishing and Buffing Techniques" by Dr. Henry L. Kellner, the Lea Manufacturing Company.

For the many ladies present, the program produced by the Ladies Committee comprised of Mrs. Ernest Owens, Mrs. Charles Posner and Mrs. Charles J. Bossong included a luncheon and fashion show. In addition, there were other delightful pool-side and sightseeing events.

The Region held an afternoon business meeting of its Delegates Saturday afternoon. Among other business transacted, it resolved and announced that the Third Annual Dixie Regional Educational Meeting will be held February 3–4, 1961 in Roanoke, Virginia, with the Blue Ridge Branch as host.

A cocktail party preceded the Farewell Banquet that filled the Saxony's oceanfront ballroom. Chairman Dent served as Master of Ceremonies. National President Wysong and National Executive Secretary Nichols were the principal speakers. Dixie Branch leaderships present included Branch President Owens of Miami and Robert Taylor of Southeastern, and Branch First Vice President Bruce Wallace represented Blue Ridge. A floor show was followed by dancing against the background of a Miami full moon.

The Miami Branch Committee heads greatly responsible, under President Owens and Chairman Dent, for the success of the Miami Beach enterprise included Earl Kennedy (Registration); Charles Posner (Entertainment); W. J. Donnelly and C. E. McNally (Educational); Abe Schorr (Hotel and Banquet); J. N. Gibbs and Rolla E. Taylor (Welcome); Frank X. Marinello (Program) and C. J. Bossong and J. B. Dasher (Publicity & Plant Visitation).

George Taylor (Southeastern) is the current coordinator and Dixie Regional Treasurer, and the Dixie Regional Advisory Board is made up of Robert H. Probert, H. R. Stogner Sr., Robert Taylor and Mrs. Jerita D. Wilson.

**AT THE DIXIE REGIONAL ROSTRUM, l to r, General Chairman Duke Dent, National President Ralph D. Wysong, National Executive Secretary John P. Nichols, Coordinator George Taylor.**

(Top left) Speakers at New York Annual Educational Session. Left to right, John G. Beach, Battelle Memorial Institute; Dr. Richard B. Saltonstall, The Udylite Corp.; Ronald Dow, Metal & Thermit Corp. (Top right) A few of the interested listeners at Educational Session. (Bottom left & right) Dancers and diners at the Banquet.

## MOTHER BRANCH STAGES OUTSTANDING WINTER MEETING

The New York Branch of American Electroplaters' Society, Inc. (AES) observed its fifty-first year of life with an Annual Technical Session and Banquet held at the Statler-Hilton Hotel, New York City, Saturday, February 6, that rivalled its Fiftieth Anniversary Educational Sessions and Banquet held the prior year for supremacy among the best such events held by the AES "Mother" Branch in its long history.

With Branch Librarian Martin Pollack presiding, the Educational Session occurred in the Georgian Room starting at 2 p.m. with an audience of nearly 100 New York and other Branch members present, and featured three technical papers by experts. Dr. Richard B. Saltonstall, The Udylite Corporation, delivered "The Role of Agitation in Plating"—J. G. Beach, Battelle Memorial Institute treated "Plating on the Less Common Metals"—Ronald Dow of Metal and Thermit Corp. presented "Duplex Chromium." Meantime, for the ladies, there was a tea and card party in the Georgian Room foyer, with plentiful gifts and prizes.

Under the aegis of the Metal Finishing Suppliers' Association (MFSA), a well-attended and well-liked cocktail party in the Penn Top of the hotel followed the technical sessions. Then came the New York Branch's traditionally noteworthy banquet in the handsome Terrace Room with a large assembly present. The floor show that sweetened the banquet was among the best of the current AES season. And outstanding too was its red-covered printed program book.

Aside from National First Vice President W. Andrew Wesley, National Executive Secretary John P. Nichols, Past AES President George P. Swift, and their wives, a large number of industry, company, Association, publication and AES Branch leaders and their wives and guests were present, including Justus A. Stremel, one of the AES's five living founding fathers, these being Harry C. Bernard (New York), William Schneider (New York), Edward W. T. Faint (Newark) and Frederick F. Pierdon (Baltimore-Washington), beside Mr. Stremel also of the New York Branch.

## FULL-DAY ANNUAL RECEIVES PLAUDITS AT GRAND RAPIDS

The Twenty-Second Annual Educational Session and Dinner Dance of the Grand Rapids Branch was held on Saturday, January 23, at the Pantlind Hotel, in downtown Grand Rapids. It was reportedly a "bang-up success" with an interesting educational program, followed by excellent entertainment in the evening. For the first time, a joint suppliers' group representing the metal finishing industry sponsored a cocktail hour before the banquet and refreshments during the evening.

The program began at 10:00 a.m. in the Continental Room. Don Smith, Branch president, introduced National President Ralph "Duke" Wysong of Studebaker-Packard Corp., moderator for the educational sessions.

The first speaker, William E. Lovell, Ternsted Division of General Motors Corp., presented a paper on Dual Chromium. Mr. Lovell recapped the extensive investigation conducted at Ternsted of various dual chromium systems.

Arthur H. DuRose of Harshaw Chemical Co. presented the story of "Improved Corrosion Resistance Available Through the Use of Duplex Nickel." He emphasized the characteristics of the semi-bright deposit versus the bright deposit as affecting possible mechanism of corrosion resistance.

The morning session was concluded at approximately 12 noon, at which time a luncheon sponsored by the metal finishing suppliers group was served.

After lunch, Branch President Don Smith, introduced AES's National Officers present. Among them were Herberth E. Head of Chrysler Corp., National Immediate Past President; active member of the Grand Rapids Branch Chet Borlet, National Second Vice President; and Manuel Ben of General Motors Research Laboratories, National Third Vice President.

Speaker for the afternoon session was Maurie Caldwell of Doehler-Jarvis Division of National Lead Co., also a National Past President. Mr. Caldwell presented a paper entitled "The Evaluation of Modern Methods of Improving the Corrosion of Plated Zinc Base Die Castings," co-authored with Lyman Sperry, chief chemist of Doehler-Jarvis.

GRAND RAPIDS ANNUAL TECHNICAL SESSION. All names left to right. (Left photo) Part of the audience. On the dais, National President Ralph D. Wysong, Moderator of the session; Arthur H. DuRose delivering paper; Branch President Don Smith. (Center) Participants in the educational program, Arthur H. DuRose, William E. Lovell, Don Smith, Maurice R. Caldwell, Educational Chairman Bill Griffin, Ralph D. Wysong. (Right) Lyman B. Sperry, Messrs. Caldwell, Lovell, DuRose and Wysong.

# 10 QUESTIONS, 10 ANSWERS IMPORTANT CONCERNING 47th ANNUAL CONVENTION

**I WHERE WILL NEXT CONVENTION BE HELD?**

AES's 1960 Convention will be held at the Statler Hilton Hotel, Los Angeles, California.

**II UNDER WHOSE LOCAL SPONSORSHIP?**

The Society's Los Angeles Branch, its West Coast pioneer, will serve as Host Branch.

**III WHAT ARE ITS DATES?**

The Convention will be held July 24-28, 1960.

**IV WHAT IS THIS CONVENTION'S SPECIAL IMPORT?**

This is the first AES National Convention conducted beyond the Rockies—in fact, west of the Mississippi—in the Society's half-century lifetime. The entire Western segment of AES, eleven Branch strong, is particularly anticipating that historic occurrence.

**V WHAT IS ITS EDUCATIONAL SIGNIFICANCE?**

So as to stimulate the largest possible AES attendance at this first West Coast AES National Convention, the AES, through its Editorial Board and the Host Branch Convention Educational Committee, has fashioned an outstanding package of educational Sessions. Nine such sessions will feature 33 quality technical papers. A highspot will be the "Second Annual William Blum Lecture." It will be delivered by Dr. A. Kenneth Graham, second winner of the AES Scientific Achievement Award, the Society's highest scientific honor. It will also present a full day's "Hydrogen Embrittlement in Metal Finishing Symposium", supplemented by an evening forum on that same subject. It will also have an organic coating session. The balance of the versatile program will comprise technical papers by experts on a wide variety of other subjects of significance to electroplating, metal finishing and allied arts.

**VI WILL THE LADIES ENJOY ATTENDING?**

The Ladies always enjoy attending AES National Conventions and should certainly have a veritable "ball" at this one. Against the backdrop of the "Wonder City's" climate and glamour, they will have an opportunity to create lifelong memories. Among pleasures to be treasured will be a poolside luncheon at the renowned Beverly Hilton Hotel, with entertainment including a California fashion show and a fancy diving exhibition. They will partake, with their families, of Disneyland's fabulous fare. They will visit Hollywood. They will explore and shop at famed Farmers Market. They will have opportunity to roam—and see—and be seen—and, in many other ways, live their dreams and fetch home remembrances.

The fabulous Beverly Hilton where the AES ladies will lunch and play.

**VII WILL CHILDREN BE ACCOMMODATED?**

More than any other AES National Convention—and par, at least, with the memorable Convention of 1956 in our Nation's Capital—this Los Angeles Convention will cater to AES's youngsters and will go out of its way to give them fun-filled days. Beamed to fulfill young dreams, the Children's Program will give them a "youth's-eye view" of the Los Angeles things youth wants to see. With their folks, they will exhilarate in Disneyland. Supervised, they will explore the wonders of Marineland and caper at Knott's Berry Farm. They may tour a motion picture studio and see stars in action. With other AES youngsters, they will have a bus view of the "Homes of the Stars". Together, they will spend a glorious day at the ranch either of "Crash" Corrigan or of Gene Autry. If their folks so desire, they will also attend the gala farewell banquet of the Convention, and view the delightful floor show that will be a feature of it.

**VIII WHAT IS THE ADULT REGISTRATION FEE?**

For both male and female adults, the registration fee of the Los Angeles Convention will be $25.00 per person.

**IX WHAT IS THE CHILDREN'S REGISTRATION FEE?**

The registration fee for each child will be $18.00. This will include transportation, chaperones and box lunches. It will not include a banquet ticket. If desired, these can be obtained at the usual banquet ticket price.

**X WHAT SHALL I DO TO GET READY TO ATTEND?**

Make up your mind early that you and yours just simply cannot afford to miss this California opportunity. Then, as soon as you receive the Hotel Reservation Form from the Los Angeles Branch Convention Committee via AES Headquarters, accomplish and mail it without delay so as to assure yourself of hotel accommodations. Next make transportation reservations at earliest possible time to suit yourself. You're now all set for education by day, and for California-style fellowship and fun thereafter, at AES's 47th Annual Convention in America's Pacific-side "Wonder City", July 24-28, 1960.

WATER WONDERLAND. Neptune's Courtyard entrance to Pacific Ocean Park in Santa Monica, Calif., sparkles with splendor in California twilight.

## TENTATIVE PROGRAM

**This is a TENTATIVE PROGRAM as of February 29, 1960. Additions and modifications will be made monthly until finalized.**

### SUNDAY, JULY 24

| | | |
|---|---|---|
| 9:00 a. m. | Executive Board Meeting (All Day) | Dallas Room (Hq. Room) |
| 2:00 p. m. | Honorary Membership Award Committee Meeting | Washington Room |
| 2:00 p. m. | Scientific Achievement Award Committee Meeting | St. Louis Room |
| 3:00 p. m. | Ladies Program. California Welcome Tea | (To be Announced) |
| 4:00 p. m. | Credentials Committee Meeting with Executive Board | Dallas Room |
| 8:00 p. m. | Get-Together Party | (To be Announced) |

### MONDAY, JULY 25

| | | |
|---|---|---|
| 9:00 a. m. | Children's Program—Supervised Visit to Marineland and Knott's Berry Farm (subject to change) | (Bus time to be Announced) |
| 10:00 a. m. | Grand Opening Session | Golden State Room |
| 11:00 a. m. | Business Meeting, Supreme Society | Golden State Room |
| 12:00 noon | Branch Secretaries' Luncheon | New York Room |
| 12:00 noon | Ladies Program. Luncheon and Entertainment | (To be Announced) |
| 12:15 p. m. | Speakers' Luncheon | Cleveland Room |
| 2:00 p. m. | Educational Opening Session<br>Second Annual "William Blum Lecture"<br>(Dr. A. Kenneth Graham, Second Winner, "AES Scientific Achievement Award".) | (To be Announced) |
| 2:00 p. m. | Plant Inspection Trip | (To be Announced) |
| 2:30 p. m. | Editorial Board Meeting | Boston Room |
| 2:30 p. m. | Midwest Regional Council Meeting | Dallas Room |
| 2:30 p. m. | Educational Session A<br>"Applying Statistical Quality Control to Plating Processes"<br>"Chemical Milling"<br>"Hazards in the Plating Room" | (To be Announced) |
| 2:30 p. m. | Educational Session B<br>"Adhesion of Organic Enamels to Electrodeposited Nickel"<br>"Solid Film Lubricants as Organic Finishes"<br>"Magnesium Corrosion" | (To be Announced) |
| 4:00 p. m. | Order of Past Presidents' Business Meeting | Detroit Room |
| 6:30 p. m. | Order of Past Presidents' Dinner | Washington Room |
| 8:00 p. m. | Convention Ball (Sponsored by Metal Finishing Suppliers' Association) | (To be Announced) |

### TUESDAY, JULY 26

| | | |
|---|---|---|
| 8:00 a. m. | Charles Henry Proctor Memorial Leadership Award Selection Committee Breakfast | (To be Announced) |
| 8:00 a. m. | Speakers' Breakfast | Cleveland Room |
| 9:00 a. m. | Membership Committee Meeting | (To be Announced) |
| 9:00 a. m. | Public Relations Committee Meeting | Detroit Room |
| 9:00 a. m. | Southwestern Regional Council—Organization Meeting | Dallas Room |
| 9:00 a. m. | Educational Session C<br>"Recent Developments in Gold Electroplating"<br>"A Cyanide Bath for Heavy Gold Plating"<br>"Acid Gold Plating"<br>"Precious Metal Plating and Printed Circuits" | (To be Announced) |
| 9:00 a. m. | Educational Session D<br>"Outdoor, Accelerated and Galvanic Test Results on Nickel-Chromium Deposits"<br>"A Progress Report on Experiences in Improving the Corrosion Resistance of Automotive Parts"<br>"New Data on the Performance of Nickel and Chromium Plated Zinc Die Castings"<br>"A Study of Variations in Certain Characteristics of Bright Nickel Deposits with Variations in Bath Temperature" | (To be Announced) |
| 2:30 p. m. | Annual Outing (Busses leave Statler Hotel) | Disneyland |

## WEDNESDAY, JULY 27

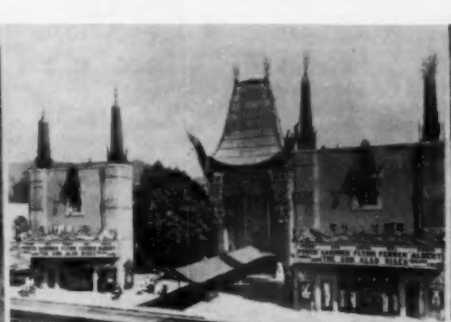
8:00 a. m. **Research Committee Breakfast** ..... Cleveland Room
8:00 a. m. **Speakers' Breakfast** ..... Buffalo Room
9:00 a. m. **Educational Session E—"Hydrogen Embrittlement in Metal Finishing"**
**Symposium** ..... (To be Announced)
"The Metallurgical Aspects of Hydrogen Embrittlement in Metal Finishing"
"On the Mechanism of Transport of Hydrogen across a Metal Interface"
"The Behavior of Hydrogen in Iron and Steel"
"Detection and Control of Chemisorbed Hydrogen during Electrolysis"
9:00 a. m. **Research Committee Meeting** ..... Detroit Room
9:00 a. m. **Publications Committee Meeting** ..... Boston Room
9:00 a. m. **Educational Committee Meeting** ..... Washington Room
9:00 a. m. **Children's Program—Supervised bus view of "Homes of the Stars" and guided tour, motion picture studio (subject to change)** ..... (Bus time to be Announced)
12:00 noon **Joint Educational Committee and Branch Librarians' Luncheon** ..... New York Room
12:00 noon **Speakers' Luncheon** ..... Buffalo Room
12:30 p. m. **Ladies' Program "Luncheon Around the Aqua Pool" and California Fashion Show** ..... Beverly Hilton Hotel
2:00 p. m. **Research Committee Meeting** ..... Detroit Room
2:00 p. m. **Educational Session F—"Hydrogen Embrittlement in Metal Finishing"**
**Symposium** ..... (To be Announced)
"Measurements Pertaining to Hydrogen Embrittlement"
"A New Look at the Hydrogen Embrittlement of Cadmium Coated High Strength Steels"
"Effectiveness of Metallic Undercoats in Minimizing Plating Embrittlement of Ultra High Strength Steels"
"Control of Hydrogen Embrittlement by Plating from Cadmium Cyanide Baths Containing Nitrate"
7:30 p. m. **Round Table Discussion on "Hydrogen Embrittlement in Metal Finishing"** ..... (To be Announced)
9:30 p. m. **Floor Show and Dance** ..... Pacific & Sierra Rooms

## THURSDAY, JULY 28

8:00 a. m. **Speakers' Breakfast** ..... St. Louis Room
9:00 a. m. **Ladies' Program. TV Show and Breakfast in Hollywood** ..... (Bus time to be Announced)
9:00 a. m. **Business Meeting, Supreme Society** ..... Sierra Room
9:00 a. m. **Educational Session G** ..... (To be Announced)
"Magnetic Properties of Electrodeposited Cobalt Alloys"
"Plating of Nickel, Cobalt, Iron and Cadmium from Sulfamate Solutions"
"The Chemical Reduction of Nickel-Phosphorus Alloys from Pyrophosphate Solutions"
9:00 a. m. **Educational Session H** ..... (To be Announced)
"Cleaning Techniques in the Electronics Industry"
"Solution Transfer in Barrel Plating"
"Chromium Plating of Rifle Barrels"
9:00 a. m. **Children's Program—Supervised visit of Corriganville or Gene Autry Ranch (Subject to change)** ..... (Bus time to be Announced)
9:30 a. m. **Plant Inspection Trip** ..... (To be Announced)
11:00 a. m. **Ladies' Program. Bus View of "Homes of the Stars"** ..... (Bus time to be Announced)
12:30 p. m. **Ladies' Luncheon (Dutch Treat) and Shopping, Farmer's Market** ..... Farmer's Market
1:00 p. m. **Plant Inspection Trip** ..... (To be Announced)
2:00 p. m. **Business Meeting, Supreme Society** ..... Sierra Room
2:00 p. m. **Educational Session I** ..... (To be Announced)
"AES Research and Its Seven Active Projects" by Research Committee Chairman James D. Thomas
"New Methods of Chromium Plating Directly on Aluminum"
"Corrosion Protection with Decorative Chromium"
"Experience in the Operation and Performance of Dual Chromium Systems"
6:00 p. m. **Cocktail Party (Sponsored by Metal Finishing Suppliers' Association)** ..... (To be Announced)
7:00 p. m. **Annual Banquet and Dance** ..... Pacific & Sierra Rooms

## FRIDAY, JULY 29

8:00 a. m. **President's Breakfast to National Officers & Families** ..... AES Executive Suite
9:00 a. m. **Executive Board Meeting** ..... Dallas Room



# Hotel Reservation Request

## American Electroplaters' Society

**Los Angeles, California—July 24-28, 1960**

MISS NINA L. McGOVERN
HOUSING COMMITTEE, A.E.S.
LOS ANGELES CONVENTION BUREAU, INC.
404 SOUTH BIXEL STREET, LOS ANGELES 54, CALIFORNIA

AES Member?_____
YES OR NO

(Please print or type)

1st CHOICE: HOTEL_____ 3rd CHOICE: HOTEL_____
2nd CHOICE: HOTEL_____ 4th CHOICE: HOTEL_____

ACCOMMODATIONS DESIRED: RATE DESIRED:

_____Room(s) with one bed for one person (Single) ..... $_____ to $_____
_____Room(s) with twin beds for two persons (Twin) ..... $_____ to $_____
_____Room(s) with one bed for two persons (Double) ..... $_____ to $_____
_____Suite(s) parlor and one bedroom ..... $_____ to $_____
_____Suite(s) parlor and two bedrooms ..... $_____ to $_____

ARRIVAL TIME: Date_____ Hour_____ DEPARTURE TIME: Date_____ Hour_____

LIST NAMES OF ALL PERSONS WHO WILL OCCUPY EACH ROOM:

Name Street Address City and State

_____
_____
_____
_____
_____
_____
_____

CONFIRM RESERVATION TO: Name_____
Company_____
Street Address_____
City_____ Zone_____ State_____

LOS ANGELES CONVENTION HOTELS (Daily Rates, Subject to Change)

| | Singles | Doubles | Twins | Suites |
|---|---|---|---|---|
| Statler Hilton (Headquarters) | $8.00–$14.50 | $11.50–$17.00 | $12.00–$18.50 | $23.00–UP |
| Mayfair | 7.00– 10.00 | 9.00– 13.00 | 10.50– 13.00 | 22.00–34.00 |
| Commodore | 5.00– 9.00 | 8.00– 12.00 | 8.00– 12.00 | 14.00–35.00 |
| Biltmore | 8.00– 15.00 | 11.50– 17.00 | 12.50– 18.50 | 20.00–50.00 |

Please give ALL of the information requested and mail this form to the Los Angeles Convention and Tourist Bureau. All reservations must be cleared through the Housing Committee. Blocks of rooms have been allocated for our use in the hotels listed. The Housing Committee must have the names of all persons who will occupy each room. No block reservations will be made.

Placement will be made in the order received. Your choice of hotels will be followed if rooms are available. Otherwise, assignment will be made to best possible advantage elsewhere. You will receive a confirmation directly from the hotel. If you desire accommodations in a Los Angeles hotel not listed, please so indicate.

IF YOU HAVE NOT ALREADY MADE YOUR HOTEL RESERVATIONS, FILL OUT AND MAIL PROMPTLY

## ADVANCE VIEWS OF 7th INTERIM MEETING AND PHILADELPHIA 50th ANNIVERSARY

(1) AES Research Committee Meeting all day Thursday, February 18. Left to right, Dr. Harold J. Wiesner, Clarence H. Sample, Raymond Mitchell, Chairman James D. Thomas and Walter Moline. Present but not shown in picture Dr. William Blum, AES National Executive Secretary John P. Nichols, Vice Chairman-Research Dr. D. Gardner Foulke and Vice Chairman-Finance Kergan Wells. (2) National Educational Committee Meeting Thursday evening. Dr. Nelson F. Murphy, Dr. Dodd S. Carr, Ralph H. McCahan and AES First Vice President Dr. W. Andrew Wesley. (3) AES Executive Board Meeting all day Friday, February 19. Second Vice President Chester G. Borlet, Third Vice President Manuel Ben, President Ralph D. Wysong, National Executive Secretary John P. Nichols, Past President Herberth E. Head and First Vice President W. Andrew Wesley. (4 and 5) Dais at the Grand Opening, 50th Anniversary Technical Sessions. Joseph W. Berenato Jr., Branch Librarian; Dr. Samuel Heiman, chairman Educational Sessions; James E. Cogan Jr., Branch President; Ralph D. Wysong; Dr. W. Andrew Wesley, speaker; Chester G. Borlet; Manuel Ben; Herberth E. Head; John P. Nichols; I. William Marcovitch, Branch Secretary; John B. Winters, speaker. (6) View of part of the audience at the opening Technical Session. (7) Branch officers and speakers dinner Friday evening. Paul Mentzer Sr., treasurer; Dr. Samuel Heiman; Dr. Harold J. Wiesner; Joseph W. Berenato Jr.; James E. Cogan Jr.; Edward M. Hoffmann Jr., first vice president; I. William Marcovitch; Dr. W. Andrew Wesley; Irvin K. Hauseman, second vice president. (8) Early registrants for Philadelphia Branch's Fiftieth Anniversary and the Seventh Interim Meeting. (9) Branch President Cogan and National President Wysong with Philadelphia Mayor Richardson Dilworth's Proclamation and the Branch's 50-year-old Charter. (10) Group leaving for the plant tour of American Machine and Metals, Inc. on Friday. (11) Friday evening joint meeting of the American Electroplaters' Society Executive Board and the Metal Finishing Suppliers' Association Board of Trustees. Ezra A. Blount, Eugene Combs, Chester G. Borlet, Earl W. Couch, Manuel Ben, Dr. Henry L. Kellner, Manson Glover, Ralph D. Wysong, Herberth E. Head, John P. Nichols, Harold J. McCracken, Robert M. Norton, Fred P. Green, A. P. Munning, John Trumbour and Sherman M. Goble. (12) Branch President Cogan, at the podium, welcomes attendants to Philadelphia's Golden Anniversary celebration.

# INTERSOCIETY NEWS

## TECHNICAL SOCIETIES SPONSOR INDUSTRIAL FAIR

The 8th Annual "Industrial and Engineering Fair" sponsored by the Technical Societies Council of the Niagara Frontier will be held in the Buffalo Memorial Auditorium April 19–21, 1960. Over the years, this Fair has become a sort of showcase of industry in Niagara Frontier sometimes known as the "Cross Roads of North America".

Some 38 Technical Societies including American Electroplaters' Society, American Chemical Society, American Society of Tool Engineers, Electrochemical Socity, Institute of the Aeronautical Sciences and others are among those composing the Council sponsoring said "Fair".

Ralph Simonette, president of the Council and Fair Coordinator states that this Industrial and Engineering Fair is industry's opportunity to share in the vast contemplated expansion of industry on the Niagara Frontier. "The Fair," he holds, "will provide opportunity to companies and others to show their products and to discuss them personally with thousands of engineers, scientists and technicians who will choose products to be purchased during that area's projected great growth."

Registration and admission will be by membership card of a member Technical Society or by tickets to be supplied by exhibitors. The AES's Buffalo Branch is among those that have engaged booths. Through it, the Buffalo Branch expects to stimulate interest in plating and metal finishing plus membership in AES.

Any company or individual desiring further information concerning the Fair is invited to communicate direct with Mr. Simonette, Room 62, Statler Hilton Hotel, Buffalo 2, New York. The phone is Cleveland 2298.

## PURDUE WASTE CONFERENCE

The Fifteenth Purdue Industrial Waste Conference is set for May 3, 4 and 5, 1960. The meetings will be held in the Purdue Memorial Union Building of Purdue University in Lafayette, Indiana.

Approximately 50 papers will be presented on subjects dealing with industrial wastes and their treatment. Three of the papers already scheduled are of particular interest to the plating industry, Methods of Disposal of Plating Wastes by E. G. Beck Jr., Stolle Corp.; Electric Membrane Process-Waste Pickle Liquor, T. A. Kirkham, Ionics, Inc.; and Treatment of Chromate Wastes with Liquid Sulfur Dioxide by J. D'Orazio, Pontiac Motor Division.

Hotel reservations can be made at the Purdue Union Club, Fowler Hotel, Cedar Crest Hotel, Esquire Motel, Devon Plaza Motel, Morris Bryant Hotel or Howard Johnson Motor Lodge.

This is an open conference. Registration blanks will be mailed upon request.

VIEWS OF MFSA'S BOARD OF TRUSTEES MEETING, Conrad Hilton Hotel, Chicago, January 30. Left to right, top, A. P. Munning, A. B. Hoefer, L. A. Davies, R. F. Ledford, F. P. Green, R. M. Norton, H. L. Kellner, H. J. Struckhoff. Lower picture, facing, C. C. Helmle, J. E. Trumbour, E. L. Combs, E. A. Blount and E. W. Couch.

## MASTER ELECTRO-PLATING ASSOCIATION'S BANQUET MAY 14

**Back in 1919, on the heels of World War I, the Master Platers of New York launched their first banquet. The 42nd annual edition of that festive annual event of today's Master Electro-Plating Association, Inc. will be held—replete with reception and entertainment—in the Grand Ballroom of the Plaza Hotel, New York City, Saturday, May 14, 1960. Always a prime social event of the industry, this year's banquet tickets are, as usual, priced at $25 each and are available at the Association's offices, 59 East Fourth Street, New York, N.Y.**

## MFSA TRUSTEES LAY LOS ANGELES CONVENTION PLANS

The Board of Trustees of the Metal Finishing Suppliers Association (MFSA) met in scheduled regular Winter Meeting, January 30, at the Conrad Hilton Hotel, Chicago, and conducted a wealth of business, including plans for revamping the style of its soiree traditionally sponsored by the MFSA at AES National Conventions. President R. F. Ledford of the Chem-Ray Corporation presided.

Among other business transacted, the Board reviewed policy subjects to be discussed at the joint AES Executive Board—MFSA Board of Trustees Meeting to be held in the AES Executive Suite, Ben Franklin Hotel, Philadelphia, Pennsylvania, Friday evening, February 19, the evening prior to the SEVENTH INTERIM MEETING of the Supreme Society. Subjects discussed included the Association's preference as to the year of the next AES Industrial Finishing Exposition.

Beside President Ledford, Treasurer Ezra A. Blount and Secretary A. P. Munning, there were present at the Trustee's Chicago meeting, January 30, Messrs. Earle W. Couch and Dr. H. L. Kellner, Lea Manufacturing Co.; Robert M. Norton, Hanson-Van Winkle-Munning Co.; C. C. Helmle, Enthone, Inc; G. E. Huenerfauth and Fred P. Green, Crown Rheostat and Supply Co.; L. A. Davies, Davies Supply Company; John Trumbour, "Metal Finishing," Eugene L. Combs, Diamond-Alkali Company; A. B. Hoefer, Frederic B. Stevens, Inc.; Herman J. Struckhoff, Laco Engineering and Sales Inc., liaison officer for the coming convention; George Stutz, George Stutz Company and Harold W. Baker, NAMF liaison to MFSA.

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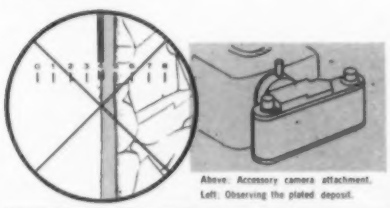

Above: Accessory camera attachment. Left: Observing the plated deposit.

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## NAMF ADOPTS CODE OF ETHICS

A Code of Ethics and trade practices was recently adopted by the board of directors of the National Association of Metal Finishers (NAMF) that reportedly is the first of its type adopted affecting the job plating industry.

Final board approval followed close to two years of research and study by the NAMF's "Ethical Standard Practices Committee" under the leadership of John T. Hyduke of Durable Plating Co. of Cleveland.

The Code of Ethics is reportedly broken down into two phases, namely 1) a so-called "Metal Finisher's Ten Commandments" and 2) a "detailed three-and-a-half-page set of ground rules."

## CRAWFORD CHAIRMAN OF CHICAGO ELECTRO-PLATERS

Election of officers and directors was held at the recent annual meeting of the Chicago Electro-Platers Institute. The new slate of officers consists of William R. Crawford, Chrome-Rite Co., chairman; Joseph Grudzis, Brookline Industries, Inc., vice chairman; William Carlson, Arrow Plating Co., Inc. secretary-treasurer.

The directors are Richard Giesel, Adolph Plating, Inc.; Chet Kennedy, American Buffing and Processing Co.; Anthony Campisi, Specified Plating Co.; and George Strom, Ada Plating Works.

## AZI ANNUAL MEETING

The American Zinc Institute will hold its 42nd Annual Meeting at the Chase-Park Plaza Hotels in St. Louis, Missouri on Thursday and Friday, April 7 and 8.

The first session will be held Thursday morning in conjunction with the Galvanizers Committee of the steel industry and the Lead Industries Association.

AZI's Thursday afternoon session will include a report on the use of galvanized sheet for prefabricated buildings as well as a detailed progress report of American Zinc Institute's recently accelerated Expanded Research Program.

The third, and final, session scheduled for Friday morning will consist of reports of trends in zinc oxide and brass, die casting, and rolled zinc, and will include a discussion of mining economics.

## IMF SPRING CONFERENCE

The Institute of Metal Finishing of England will hold its annual spring conference at the Grand Hotel, Scarborough, England on April 26 and continuing through April 30. Details of the papers to be presented and the various functions can be obtained from the headquarters of the Institute of Metal Finishing, 32 Great Ormond Street, London, WC1, England.

## DETROIT INDUSTRIALISTS ASTME HONORARY HOSTS

Five Detroit industrial leaders comprise the American Society of Tool and Manufacturing Engineers' honorary host committee for the 1960 Engineering Conference and exhibit in the Motor City, April 21 to 28.

Serving on the committee are L. L. Colbert, president of Chrysler Corp., Malcolm P. Ferguson, president of Bendix Aviation Corp., Henry Ford II, president of Ford Motor Co., John F. Gordon, president of General Motors Corp., and George Romney, president of American Motors Corp.

Concurrent with the conference, in downtown Detroit hotels, the society will stage a scientific and educational exposition at the Artillery Armory, West Eight Mile Road. More than 500 exhibitors will participate.

Leslie B. Bellamy (vice president, Abrasive and Metal Products Co., Detroit), chairman of the Detroit host committee for the events, said the program will include 17 plant tours, 34 technical sessions and a two-day seminar on dimensional metrology (the science of measurement). Over 35,000 manufacturing executives and engineers from around the nation are expected in Detroit for the eight-day conference.

## BEST HEADS NACE

New officers have been elected to head the National Association of Corrosion Engineers for the period beginning March 1960 and ending March 1961. George E. Best, Manufacturing Chemists' Association, Washington, D. C., and AES member will be president. Edward C. Greco, senior research chemist of the research department United Gas Corp., Shreveport, La., is vice president elect and C. G. Gribble, Jr., district manager for Metal Goods Corp., Houston, Texas, will become treasurer.

Also elected were three directors, each for 3-year terms. They are: J. S. Dorsey, Southern California Gas Co., Los Angeles, Cal., and J. E. Rench, Napko Corp., Houston, corporate representatives and T. J. Maitland, American Telephone and Telegraph Co., New York, N. Y., active member representative.

Newly elected officers will be installed on the last day of the 16th Annual NACE Conference, Dallas, March 14–18, 1960.

President-elect Best was NACE vice president in 1959–1960. He is the author of several technical papers published in AES publications and in *Corrosion*, official NACE magazine. His other NACE activities include membership on the board of directors, executive committee member of technical program committees, symposia chairman and awards committee.

Vice president-elect Greco was chairman of the NACE Technical Practices committee for 1957–59.

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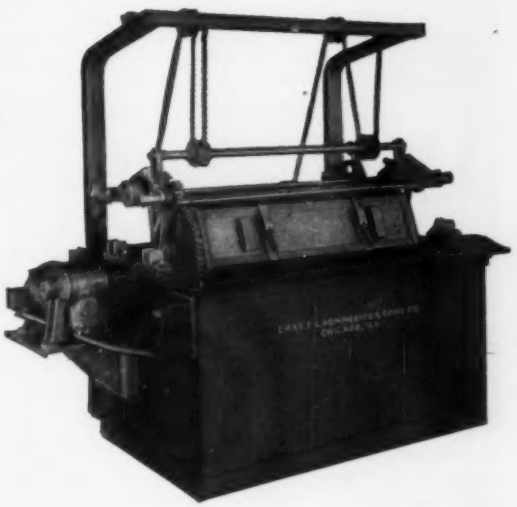

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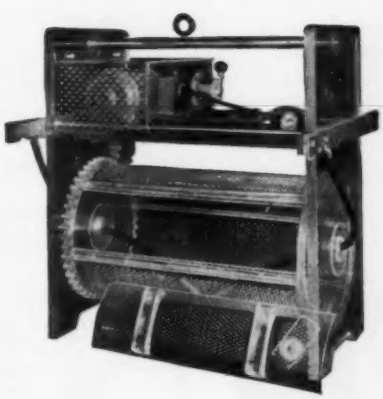

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# INDUSTRY NEWS

### NEW ULTRASONIC COMPANY

Paul Martin Platzman, New York industrialist, has announced the formation of Ultrasonic Industries, Inc. The new organization has acquired a temporary 5000-sq ft modern facility at 141 Albertson Ave., Albertson, L. I., for its immediate administrative and manufacturing needs. A lease-purchase agreement has been signed by the company for two acres of property in the Engineer's Hill section of the Plainview Industrial Park. The company plans to occupy a 36,000-sq ft building to be constructed on this site in 1960.

Mr. Platzman's associates are Herbert A. Frankel, vice president-sales; Harold S. Remz, vice president-engineering; Charles F. Combs, treasurer; Barbara A. Jewett, secretary; and John P. Brinjak, manager of manufacturing.

### PANGBORN ANNOUNCES NEW DIVISION

Pangborn Corp., Hagerstown, Maryland has announced the establishment of a new Vibratory Finishing Division.

The new corporate division, located at the company's Hagerstown headquarters, is headed by William E. Brandt who has been appointed a Pangborn division manager. To launch its new division Pangborn has designed a new line of machines.

### WATER CONDITIONING AND SOFTENER FIRMS MERGE

Paul Wynhausen, president of L & A Water Softener, Inc., Glendale, California, and Charles Fisk, president of Water Conditioning, Inc., San Gabriel, California, have jointly announced the merger of their respective firms.

The new corporation will be known as L & A Water Conditioning, Inc., and will operate from existing facilities located at 1007 Airway, Glendale.

President and general manager will be N. A. Wynhausen, S. C. Solomon will be vice president, Mr. Fisk will be treasurer of the new firm. Key employes of both firms will be retained.

### NEILSON CHEMICAL APPOINTS REPRESENTATIVES

The Neilson Chemical Co., Detroit 20, has recently appointed Zak-Cowen and Associates, Inc., 7730 Carondelet, St. Louis 5, Missouri, as sales and service representatives. They will be servicing accounts in the State of Missouri, sections of Kansas, Illinois and Indiana.

### BECCO CONSTRUCTING NEW DISTRIBUTION CENTER

Construction has begun in Lyndhurst, New Jersey, on a new distributing center for the Becco Chemical Division of Food Machinery and Chemical Corp., whose headquarters and principal production plant are in Buffalo, New York.

The new distributing center, which is expected to be completed by May 1, 1960, will replace Becco's present center in Jersey City, established in 1929. It will provide larger and more efficient storage and distribution facilities. It will also be more conveniently situated with respect to rail and road transportation facilities than the Jersey City center.

Matthew A. Noonan, Becco's district manager in New York City, will direct the distributing operations of the new center. Anthony Wieand, distribution supervisor at the present Jersey City center, will continue to be in charge of the new Lyndhurst center.

### AMERICAN BRASS TO BUILD RESEARCH CENTER

Richard M. Stewart, president of The American Brass Company, Waterbury, Conn., has announced plans for the construction of a $1,500,000. research center here. Ground will be broken in early summer, and completion is scheduled for 1961.

The Brass Company's new research center will include metallurgical, corrosion and chemical laboratories, and equipment for experimental production of new products as well as offices for the company's central technical staff.

### WYANDOTTE COMPLETES ATLANTA PLANT EXPANSION

Wyandotte Chemicals Corp. has announced completion of its Atlanta, Ga., plant expansion program to serve the entire southeastern area.

Production of the complete line of J. B. Ford Division cleaning and sanitizing products has begun, according to Ford Ballantyne Jr., Wyandotte vice president and general manager of the J. B. Ford Division.

### NEW SIEFEN COMPOUNDS PLANT AT SYRACUSE

Siefen Compounds, Inc. has opened a new plant for the manufacture of liquid

T. S. McCormick, left, Detroit District sales manager, Wyandotte Chemicals' J. B. Ford Division, accepting the award to his District for "The largest dollar sales increase in Industrial, Railroad and Aircraft Products in 1959" from P. N. Burkard, department manager.


**PRIOR ISSUES OF TECHNICAL PROCEEDINGS AVAILABLE FOR YOUR ORDER**

ASIDE from the fast dwindling supply of copies of the AES's world acclaimed GOLDEN JUBILEE EDITION of its book TECHNICAL PROCEEDINGS (1959 Edition), the Society has a limited quantity of the 1958 Edition of that book also available for sale.

Copies of the 1958 Edition are priced at $12.00 per copy domestic, $15.00 per copy foreign. Orders are processed on strictly a "first come-first served" basis. Payment in full must accompany each order.

In addition, the AES has a very limited supply remaining, with steady demand, of the 1957 Edition of its TECHNICAL PROCEEDINGS. These are priced at $10.00 per copy domestic, $12.50 per copy foreign. Payment in full must be received with each order.

In ordering, please make checks payable to American Electroplaters' Society, Inc. Mail orders to:

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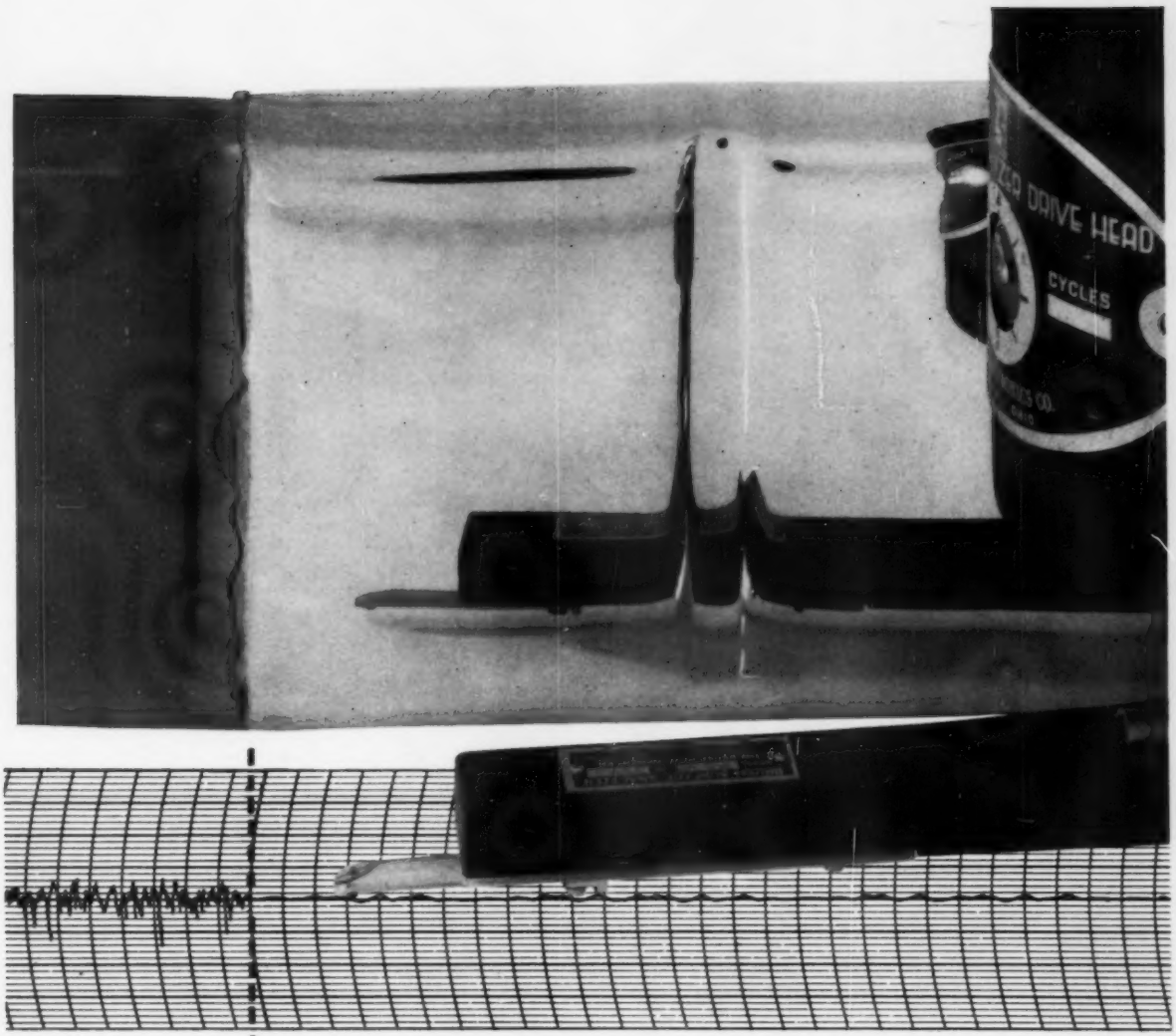


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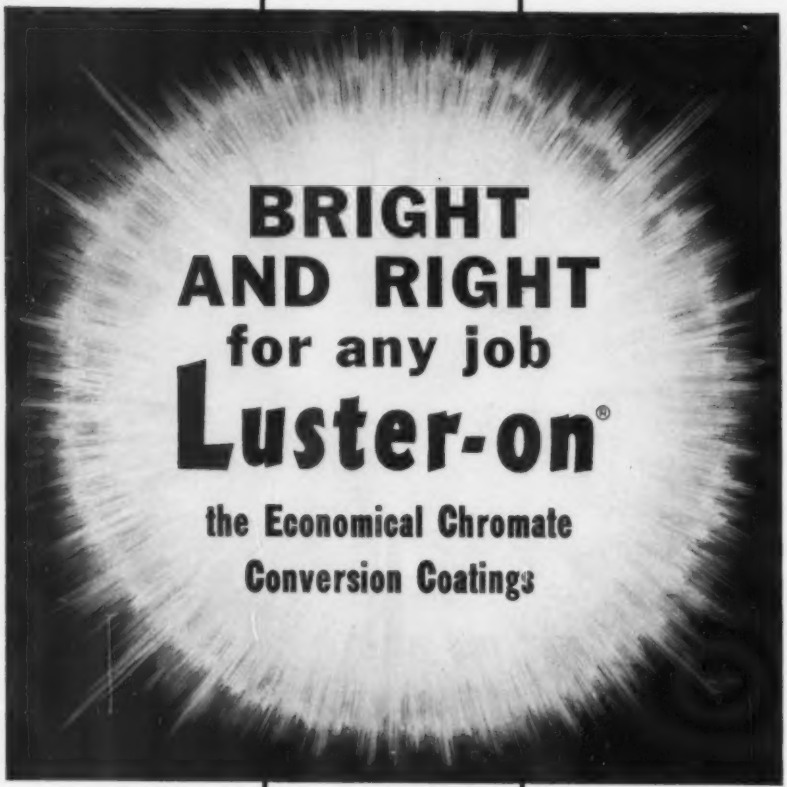


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buffing and polishing compounds at 675 Oswego Blvd., Syracuse 8, New York, according to John F. Siefern, president.

The addition of this new plant will double the production facilities of the company and will provide service to customers in the eastern part of the United States.

The present plant at 14325 Wisconsin Avenue, Detroit 38, Michigan, will continue to service the Middle West.

### FAVORABLE OUTLOOK FOR ALUMINUM IN 1960

Shipments of U. S. produced aluminum during 1960 will be the largest in history, continuing an upward trend which 1959 saw consumption of the light metal soar nearly 17 per cent above the previous record peak established in 1956, according to Frank L. Magee, president of Aluminum Company of America.

Noting in a year-end statement that 1959 domestic industry shipments rocketed to an estimated 4.8-billion pounds, or about 35 per cent above those for recession-stricken 1958, Mr. Magee expressed an opinion that the gain next year should be in the area of 10 to 15 per cent.

R. S. Reynolds Jr., president of Reynolds Metals Co. has stated that in 1960 the industry will continue its vigorous growth, aided by the major breakthroughs made into new markets in 1959.

It is entirely possible that growing demand will require nearly all of the industry's capacity some time in 1960, if business in general continues its upswing. A characteristic of the aluminum industry is that it declines more slowly than the economy in a downslide and rushes forward much faster on an upswing, according to Mr. Reynolds.

### DEARBORN CHEMICALS HAS NEW DISTRICT OFFICE

Dearborn Chemical Co., manufacturers of water treatments and coatings for corrosion control, has announced the opening of an Indiana-Michigan district office at 3001 Fairfield Avenue, Fort Wayne, Indiana.

The new office will be under the direction of T. J. Weisbruch, district manager.

### PROMAT TO DISTRIBUTE FOR WESTINGHOUSE

The Promat Division of Poor and Company has been named a distributor for Westinghouse Electric Corp.'s electroplating additive agents. Promat, with manufacturing facilities located in Waukegan, Illinois, and Gardena, California, has dealers located in all areas of industrial concentration in the United States.

The appointment of the distributorship was announced jointly by C. G. Reinheimer, manager of the Westinghouse electroplating sales department, and W. F. Stark, vice president of Promat.

# KNOWLEDGE OF INESTIMABLE VALUE IN THESE AES RESEARCH PROJECT REPORTS CURRENTLY AVAILABLE

**Cleaning and Preparation of Metals for Electroplating, IV, V, VI & VII**—By H. B. Linford & E. B. Saubestre — *Serial 26, Project 12, $3.50*

**Methods for Testing Thickness of Electrodeposits, II & III**—By H. J. Read & F. R. Lorenz — *Serial 27, Project 7, $1.35*

**Porosity of Electrodeposited Metals**—By N. Thon, D. G. Kelemen, L. Yang, S. Yang, D. Dean — *Serial 28, Project 6, 85 Cents*

**The Analysis of Electroplating Solutions for Major Constituents**—By E. J. Serfass & M. H. Perry — *Serial 29, Project 2, 90 Cents*

**Effect of Basis Metal Condition on Plating, I & II** By A. E. R. Westman & A. F. Mohrnheim — *Serial 30, Project 14, $1.10*

**Effect of Surface Finishing on Nonferrous Base Metals on Protective Value of Plated Coatings**—By G. J. Kahan, W. W. Macchia, J. M. Fairbank — *Serial 31, Project 4, 45 Cents*

**How the Small Electroplater Can Treat Cyanide Plating Waste Solutions with Hypochlorites**—By Barnett F. Dodge and Walter Zabban, Yale University, New Haven, Connecticut — *Serial 33, Project 10, 50 Cents*

**Effects of Impurities and Purification of Electroplating Solutions, IX, X & XI**—By Dr. D. T. Ewing, Dr. A. J. Smith & Dr. W. O. Dow — *Serial 34, Project 5, 50 Cents*

**Cleanability and Oil Spreading Rates**—By H. B. Linford & P. E. Grubb — *Serial 35, Project 12, 50 Cents*

**The Nature, Cause and Effect of the Porosity in Electrodeposits, I & II**—By Fielding Ogburn, Asaf Benderly and Margaret Hilkert — *Serial 36, Project 13, $1.00*

**Microthrowing Power, A Literature Search**—By Esther B. Leffler and Henry Leidheiser Jr. — *Serial 37, Project 17, 75 Cents*

**The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating IV**—By M. H. Jones, Chih-Yeu Lu and J. Zajdowski — *Serial 38, Project 14, $1.25*

**Mechanical Finishing of Metal Surfaces—Bibliography**—By C. E. Kennedy, J. E. Fritts, R. S. Modjeska, L. E. Weeg & R. V. Twyning — *Serial 39, Project 18, 50 Cents*

**The Nature, Cause and Effect of the Porosity in Electrodeposits, III, IV & V**—By Fielding Ogburn, D. W. Ernst & W. H. Roberts — *Serial 40, Project 13, 50 Cents*

**An Introduction to Fundamental Research on the Mechanism of the Electrodeposition of Metals**—By B. E. Conway and J. O'M. Bockris — *Serial 41, Project 16, $1.00*

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# INDUSTRY NEWS BRIEFS

### COPPER INDUSTRY IN 1959

Copper production in the United States reached an all time record rate for the first six months of 1959 but the year ended with the lowest annual total since 1949, according to the Bureau of Mines, United States Department of the Interior. Consumption and imports increased over those of 1958 as exports and producer's stocks declined. The average quoted price of electrolytic copper was the highest since 1956.

### COURSES IN INDUSTRIAL WASTES

Consecutive courses in industrial wastes will be offered through most of May by the Water Supply and Pollution Control unit of Training Program, Robert A. Taft Sanitary Engineering Center, PHS, Cincinnati, Ohio.

Graduate chemists and other scientists with backgrounds in water supply and pollution control may enroll for "Organic Industrial Wastes Characterization," May 9–20; "Inorganic Industrial Wastes Characterization," May 23–27, or both courses. No registration, tuition, or other fees are charged for the courses, and text manuals are provided.

Applications should be addressed to Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or to a PHS Regional Office Director.

### SIX COMPANIES FORM COPPER ASSOCIATION

Formation of Copper Products Development Association, Inc., has been made public. Six major copper producers are charter members of the organization formed to conduct research and studies "for expansion of uses of copper and copper products, and the development of new and improved copper products."

Member companies are: American Metal Climax, Inc., American Smelting & Refining Co., The Anaconda Co., The International Nickel Co. of Canada, Limited, Kennecott Copper Corp., and Phelps Dodge Corp. Any producer of copper is eligible for membership, and participation by other copper companies will be invited shortly.

Dr. Clyde Williams, for many years the key leader in and recently president of the Battelle Memorial Institute of Columbus, Ohio, has been named technical director pro tem.

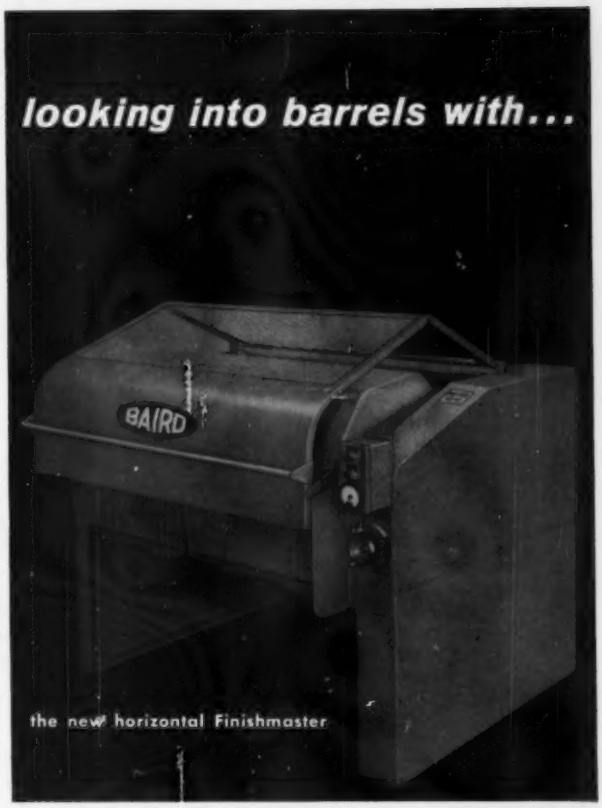
The new organization does not presently intend to provide its own facilities for investigations, but will allocate research assignments to individuals, universities, and established research organizations.

All inventions, processes, developments, or results of research, sponsored or underwritten by the association, become the property of the association. Whenever a patent is granted, the association will make available non-exclusive licenses on uniform terms to any person or concern which wishes to make use of the patent. A policy of liberal publication of unpatented developments will be followed.

### SPRAY PAINTING SCHOOL

The spring session of the Binks Manufacturing Co.'s spray painting school will cover all phases of spray finishing. Particular emphasis will be placed on two of the latest developments in the spray finishing industry—airless and electrostatic spray painting.

Instruction is given on all types of spray finishing equipment, including guns, pumps, compressors, spray booths and other related equipment. Tips on how to select the right equipment for the job, plus instruction on maintenance and care of this equipment will be covered. Enrollment can be arranged by writing to Mr. B. J. Hedger, Binks Manufacturing Co., 3114 Carroll Avenue, Chicago 12, Illinois.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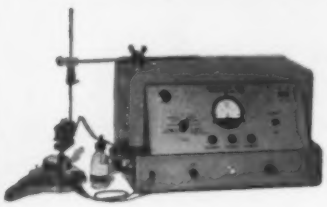

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# PATENT ABSTRACTS

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**Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.**

**No. 2,888,389, 5/26/59—Production of Magnesium**—E. Williams *et al.*, assignors to The Dow Chemical Co., Midland, Mich.

A lithium chloride-magnesium chloride molten bath for the production of magnesium and high purity chlorine is claimed.

9 claims, figure.

**No. 2,888,390, 5/26/59—Copper Refining**—R. Lapee, assignor to The Anaconda Co., Montana.

The use of $^1/_4$-5 oz of glue and $^1/_{10}$-2 oz of acrylamide polymer hydrolate in an acid copper refining bath per ton of copper deposited.

5 claims.

**No. 2,888,391, 5/26/59—Coating Metal**—Wm. F. Laughman, Somerville, Mass.

Alloy steels consisting of austenite and ferrite having a chromium content of at least 0.11 by weight may be given an acid and abrasive resistant coating by etching in sulfuric acid, washing oxidizing, water wetting and applying a resist coating containing a protein, the coated metal is heated to 400F, then made the anode in 40–60 Bé sulfuric acid to toughen the coating.

8 claims.

**No. 2,889,258, 6/2/59—Method of Making Hollow Body**—S. Failkoff, assignor to Camin Laboratories, Inc., Brooklyn, N. Y.

An electroforming method is described.

4 claims, figure.

**No. 2,889,803, 6/9/59—Galvanizing Means**—W. Pearson, Baltimore, Md.

An apparatus for galvanizing work pieces is described.

6 claims, figure.

**No. 2,890,134, 6/9/59—Hot Dip Aluminizing**—H. Linden and D. Mitchell, assignors to American Mollerizing Corp., Beverly Hills, Calif.

Claim 1 reads: "A process for the continuous coating of continuous material with a molten coating metal which comprises the steps of: immersing the material to be coated in a first molten salt bath having a temperature substantially above the melting temperature of the coating metal; passing said material immediately from said first salt bath into at least one lower-temperatured molten salt bath maintained at a temperature above the melting point of said coating metal; and withdrawing said material from the last of said lower temperatured salt bath directly into a bath of molten coating metal maintained at a temperature substantially equal to its melting point."

20 claims, 3 figures.

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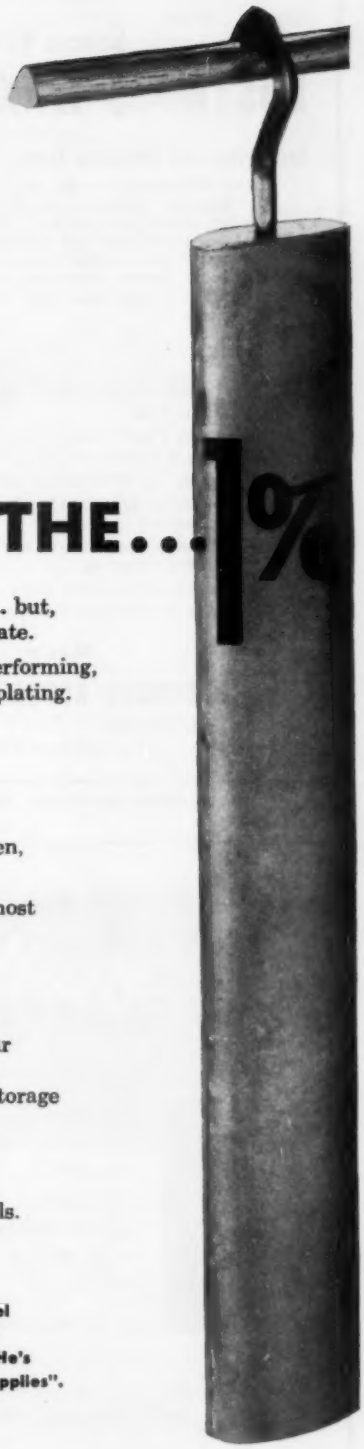


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8. Excellent adhesion on clean metal surfaces.
9. Leaves a continuous film less than .0003" thick.

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**No. 2,890,135, 6/9/59—Vacuum Metallizing**—G. Jenkins, assignor to Anadite, Inc., South Gate, Calif.

Vacuum deposition of cadmium on high tensile strength steel parts is claimed.

4 claims.

**No. 2,890,136, 6/9/59—Sisal Buff Impregnation Method**—D. Hanna, et al, assignors to Hanson-and Van Winkle Co., Ltd. Toronto, Canada.

To increase the wear resistance of sisal buffs impregnate with an aqueous emulsion consisting of 40 per cent of a solid petroleum resin, 10 per cent of a liquid petroleum resin and 5 per cent of a non-ionic emulsifier. Then heat the buff to 70 to 300F.

See also No. 2,890,137 describing the use of an emulsion for the same purpose and consisting of 27 per cent of heavy bodied soya bean oil and 0.8 per cent of an emulsifying agent.

3 claims.

**No. 2,890,160, 6/9/59—Fixture for Phonograph Record Blank**—B. Hunting et al assignors to North American Philips Co. Inc., New York

A device for suspending phonograph records in an electrolyte is described.

3 claims, figure.

**No. 2,890,991, 6/16/59—Plating Tank Connector**—W. MacLean, assignor to Florida Canada Corp. Delaware.

A copper cup arrangement as one contact and a copper stem or pole unit to enter the cup as another contact is described. The copper cup carries a solution of concentrated sulfuric acid as a conducting medium.

1 claim, 7 figures.

**No. 2,890,992, 6/16/59—Apparatus for Electrotypes**—E. Hoehl, Wauwatosa, Wisconsin.

An apparatus for plating electrotyping shells is described.

5 claims, figure.

**No. 2,891,357, 6/23/59—Apparatus for Polishing Work Pieces**—Leo Davidson, Sturgis, Mich.

A metal finishing machine of the barrel variety which includes a horizontally disposed reel journalled for rotation on fixed supports and a drum containing polishing media and compound in which the reel rotates.

18 claims, 9 figures.

**No. 2,891,884, 6/23/59—Corrosion Resistant Coating**—W. Rausch and W. Werner, assignors to Parker Rust Proof Co., Detroit, Mich.

Claim 1 reads: "An aqueous acidic solution for forming a corrosion-resistant coating on a metallic surface which comprises an alkali metal nitrite in an amount in the range of about 0.1 g/l to about 1.0 g/l, expressed as sodium nitrite, an alkali metal pyro-$P_2O_5$ content in the range of about 0.6 g/l to about 8 g/l, said solution having a *p*H in the range of about 2.7 to about 3.7."

12 claims.

**No. 2,891,896, 6/23/59—Cyanide Copper Plating Bath**—Fred Nobel, North Valley Stream and Barnet Ostrow, Bellmore, N. Y.

The use of soluble compound carrying the radical $NO_3$, $NO_2$ and NO in brass and copper baths is claimed.

10 claims.

**No. 2,891,897, 6/23/59—Apparatus for Microscopic Observation of Electrolytic Operations**—R. Zetzicke, assignor to VEB Carl Zeiss, Jena, Germany.

An apparatus is described which it is claimed permits the microscopic observation of electrolytic etching and polishing operations.

4 claims, figure.

**No. 2,891,898, 6/23/59—Electroplating Apparatus**—W. MacLean, assignor to General Development Corp., of Delaware.

An apparatus consisting of a unitary rack providing a rigid framework that is adapted for the multiple support of a plurality of elongated work pieces, disposed in a given relationship with the electrolyte is described.

7 claims, 12 figures.

**No. 2,891,979, 6/23/59—Aryl Sulfimides**—H. Ford and W. Shenk, Jr., assignors to The Harshaw Chemical Co., Cleveland, Ohio.

Compounds of the general formula.

are claimed as new compositions of matter. The specification mentions one use as nickel brighteners.

**No. 2,892,738, 6/30/59—Activation of Aluminum**—E. Dobratz, assignor to Koppers Co., Pittsburgh, Pa.

To remove oxide film from aluminum immerse in an aluminum alkyl or alkyl aluminum hydrate containing a promoter (alkali metal or alkaline compounds of alkali metals) and contact with hydrogen.

12 claims.

**No. 2,892,760, 6/30/59—Metal Electrodeposits**—W. Gündell, et al, assignors to Dehydag, Dusseldorf, Germany.

To acid electrolytes for depositing Zn, Ag, Cd, brass and bronze add a compound of the formula

Z—S—R—Q

where

*Z* is an organic radical bonded exclusively with 3 hetro atoms one of which is sulfur which links Z to R-Q.

*R* is a bivalent aliphatic radical

*Q* is a water solubilizing radical as sulfuric acid ester, phosphoric acid ester, phosphoric acid, phosphinic acid, polyether and polyalcohol radicals.

**No. 2,892,761, 6/30/59—Cadmium Plating**—W. Hamilton and E. Simon, assignors to Lockheed Aircraft Corp., Burbank, Calif.

A non-embrittling cadmium cyanide bath is described as containing 1 to 6.5 per cent of nitrate as $NaNO_3$ and a water soluble amine containing 3–8 carbon atoms as a throwing power addition.

18 claims.

**No. 2,892,762, 6/30/59—Production of Boron**—D. Stern and Q. McKenna assignors to American Potash and Chemical Corp., Delaware.

Using a boron carbide anode electrolyze a fused salt bath (alkali metal chloride and an alkali metal fluoborate, the fluoborate, the fluoborate being 3–50 per cent of the mixture) below 3 volts at 375–1000C.

See also No. 2,892,793 by same inventors for preparing elemental silicon with 7 claims and figure.

7 claims, figure.

**No. 2,892,764, 6/30/59—Production of Titanium**—E. Andrews, assignor to New Jersey Zinc Co., New York, N. Y.

An electrolytic method for producing metallic titanium is claimed.

2 claims, figure.

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# EQUIPMENT AND SUPPLIES

**E—301. Glass Shot**—Microbeads, Inc., subsidiary of Cataphote Corp. is expanding its market in the manufacturing and processing fields. Part of this growth is extension of use in cleaning and blasting.

Use of the Microscopic glass beads has been found particularly advantageous in cleaning and blasting by various wet and dry methods, and on a wide range of metals and materials. Their use has broadened the range of cleaning and sheening operations. They are adapted to high precision cleaning and blasting, such as treatment of delicate parts and surfaces, preparation of soft and hard metals for plating and other finishing, and in operations where low metal removal rate is important.

**E—302. Uniform**—A new "Resistall" weave, developed by Worklon, Inc., using 100 per cent Du Pont Dacron yarns, is being introduced in a dozen new garment stylings added to Worklon's line of special purpose industrial uniforms.

The "Resistall" weave is to be available in men's shirts, pants, coveralls, and caps . . . ladies' slacks sets . . . and in laboratory coats for both ladies and men. Like all Worklon garments, those styled in the new "Resistall" weave are of the wash-and-wear variety and require a minimum of care. They are exceptionally resistant to wrinkling and retain creases unusually well. Hence, they require little, if any, ironing.

**E—303. Buffing Machine**—Versatile, new equipment which will handle practically any buffing or grinding job in the average plant is being produced by Murray-Way Corp.

The new machine, known as the Han-D-Matic, consists of a standard low cost basic pedestal and spindle unit with a wide selection of optional, interchangeable components to accommodate practically any shape workpiece.

**E—304. Fluxing Additive**—A new fluxing additive that acts as an adhesive to keep the flux close to the base metal is now available from the Westinghouse Electric Corp. The new additive, called Wes-X 501, eliminates the critical time between fluxing and hot dipping. The additive can be used in any aqueous flux bath.

**E—305. Ultrasonic Degreaser**—The Model AC-25 Sonogen, built by Branson Ultrasonic Corp. is a new self-contained ultrasonic degreaser in a compact, stainless steel cabinet.

Measuring 44 by 18 by 36 in., the model AC-25 is said to be easily installed. It does not use separate generators, cleaning chambers, or rinsing tanks. Only water and 110-v, 60-cycle electrical connections are needed.

The degreaser has five main components: a 10 by 8 by 8-in. deep ultrasonic cleaning tank, a boiling sump, an ultrasonic generator producing 40,000 cps, transducers (in the cleaning tank) that convert the electrical energy into mechanical vibrations, and a system to recirculate filtered solvent.

A variety of fail-safe features protect the unit. A water cooling system limits evaporation loss, and an automatic interlock shuts off the sump's strip heaters if the cooling system fails.

**E—306. Temperature Alarm**—A new device which triggers an alarm when temperatures in production equipment reach an overheat condition, has been announced by Kidde Ultrasonic & Detection Alarms, Inc.

Called Temp-O-Larm, the equipment comprises a thermostat pre-set to actuate at any desired temperature. When the temperature in a production unit reaches the pre-set temperature, it sends a signal to an annunciator which causes audible and/or visible alarms to sound either locally, at a remote location.

Each annunciator has an alarm time delay that can be set from zero to six hours. This eliminates the possibility of false alarms during expected and normal overheat temperatures.

One annunciator drive unit will monitor from one to six production units and another unit that will monitor seven to twelve.

**E—307. Cleaning Compounds**—A new series of four cleaning compounds for production line cleaning of metal parts is announced by E. F. Houghton & Co. Its new Cerfa-Kleen series is limited to four products "tailored" to the requirements of four basic industrial metal cleaning processes.

HPW (hot power washer) is a heavy duty cleaning compound with no free caustic, reported as non-foaming, non-caking. Rust preventive added.

CPW (cold power washer) is a formulation of fast-dissolving alkalies usuable at room temperature. Non-foaming, non-caking, non-dusting.

HST (hot soak tank), a high detergency compound for fast immersion cleaning in hard water, is non-caking, non-dusting.

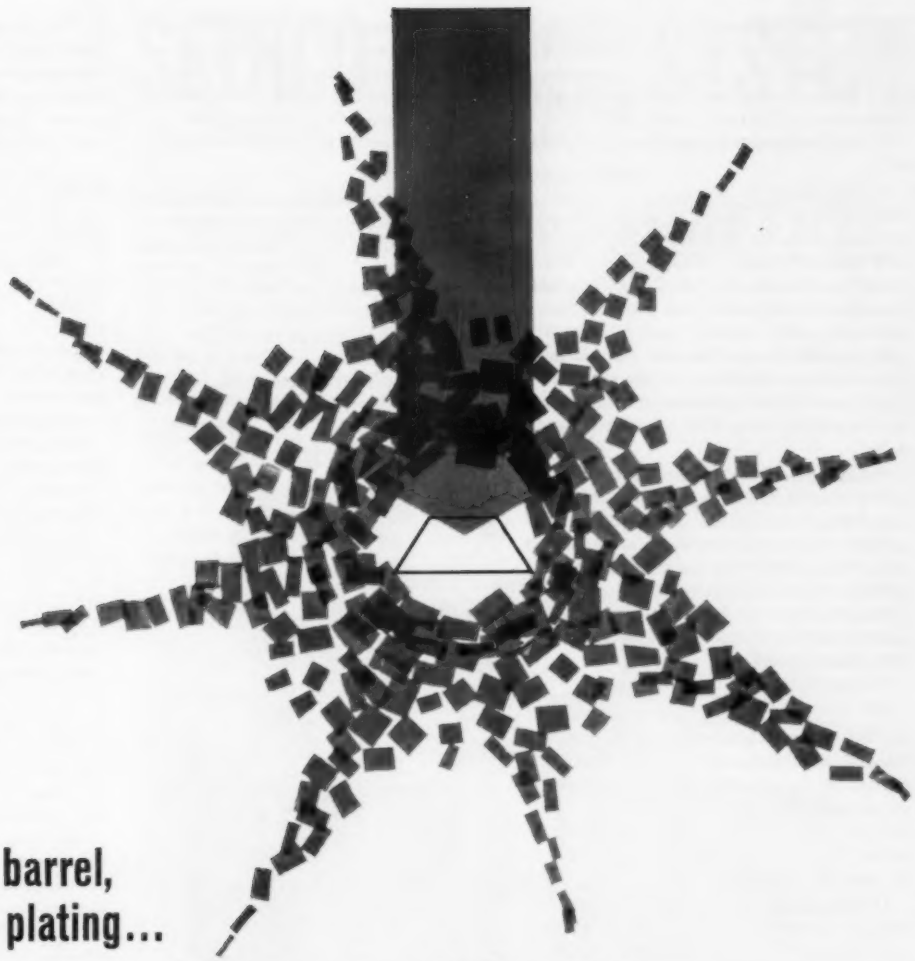
CST (cold soak tank) is a concentrated liquid to replace toxic or flammable solvents. No free caustic. Also usable for "wipe-off", tumbling and other mechanical cleaning operations.

**E—308. Chemical Polishing Dip**—Ox-Off Lustre Dip is a new chemical process said to eliminate all forms of electropolishing, machine and hand buffing. By the simple method of immersing stainless steel in the new dip for a short period of time, a mirror like finish is imparted to the surface.

It is a completely chemical process, according to Chemclean Products Corp., which does not involve the use of electrical current in any way.

**E—309. Spray Booth Stripper**—Now available from Frederick Gumm Chemical Co. is a waterfall spray booth stripper said to prevent excessive foaming and keep steel booth walls from corroding.

The compound, Clepo 57-T, used in a continuous circulation system, also is claimed to permit reclamation of excess paint in many cases. As the paint is washed down from the walls into the circulating tank, it separates from the top of the wash water and can be drawn off into a separate reclaiming tank.



## best for rack, barrel, or continuous plating...

# ZINCALUME

## one-step bright zinc process

Versatile Zincalume handles *all* methods of plating . . . all types of work . . . and plates bright *right out of the bath.* While it readily accepts conversion coatings, Zincalume eliminates the *need* for a bright dip in many applications.

Zincalume is economical, too . . . saves you money because it saves you a step no matter what plating method you use. For detailed information, write to:

**Hanson-Van Winkle-Munning Company, Matawan, New Jersey.**
**Offices in Principal Cities.**

**Alert Supply Company is H-VW-M in the West.**
**Los Angeles • San Francisco**

P.S. We are *not* out of the bright dip business. Fact is, we're proud of the one we make. A bright dip will improve brightness and shelf life of any zinc finish, but Zincalume looks fine right out of the tank or barrel.

**H-VW-M**

*Progress in metalfinishing through advanced processes • equipment*



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 341.

**E—310. Rust Preventives**—The Mitchell-Bradford Chemical Co. announces three new rust preventive products. Composition 15 for cast and malleable irons, sintered metals and steel, and Composition DR and Composition DS specifically for steel.

Composition 15—is a new rust preventive liquid to be added to either hot or cold water rinses to prevent rusting of cast and malleable irons, sintered metals and steel. It is especially adapted to porous metals which in most cases will rust immediately after rinsing especially after pickling operations. Because there is no residue left on the surface of the metal, it is claimed organic coatings can be applied to the surface without any further treatment.

Composition DR—is a new rust preventive to be added to hot or cold water rinses to facilitate drying and add corrosion resistance to the steel surface. It is designed to be used in tumbling barrel rinses to facilitate drying, eliminate staining and add corrosion resistance to the steel surfaces. There is also a Composition DS available for power washers.

**E—311. Dust Collector**—An improved integral dust collector with no filter to change is reported to handle high concentrations of dust, over a wide range of particle sizes, by using 2 in. diameter tubes of new design installed in multiple to capacity required.

Developed to remove dust in grinding, buffing, polishing, milling and cutting operations, the new unit is said to provide high collection efficiency, constant suction at hood and no fire hazard.

The new integral collector is available in seven standard sizes ranging from 300 to 2100 cfm capacity (shipping weight 300–1900 lb). The manufacturer, Aerotec Industries, Inc., also builds special assemblies ranging from a single tube of 30 cfm to capacities of 50,000 cfm and larger.

**E—312. Rectifiers**—A complete line of semiconductor rectifier power supplies for the production and testing of tantalum and other electrolytic capacitors, has been announced by Sel-Rex Rectifier Division, The Meaker Co., Subsidiary of Sel-Rex Corp., Nutley, New Jersey.

The equipment is said to utilize newly developed, non-aging silicon or selenium elements, and vernier-controlled automatic programming for simple and precise adjustment of completely automatic formation process cycles.

Sel-Rex capacitor manufacturing rectifiers also include motor-operated transformers, servo controlled and regulated; filtered output for low ripple; and positive-acting d-c overload protection, according to the announcement.

**E—313. Fume and Mist Suppresant**—A new fume and mist suppresant for use in chrome plating, anodizing, bright dipping and other metal finishing processes where gas generation is a problem has been developed by Allied Research Products, Inc.

Designated as ARP No. 21 Mistex, this new liquid material is said to act to form a thin foam blanket on the surface of the process solution. This blanket reduces fuming by trapping gas bubbles as they rise from the solution and absorbing both the gas and the vapor in the bubbles. It also reduces solution loss from mist or spray and, further, reduces drag out as work is removed from the bath.

ARP No. 21 Mistex is equally efficient in aluminum bright dips, anodizing solutions and bright or hard chrome plating baths. It is supplied in concentrated liquid form and is diluted with water in ratios varying from 3 to 20 parts before adding to the bath.

**E—314. Washing Machine**—Designed for batch cleaning of a wide variety of metal parts and assemblies, ranging from such small parts as die sets and fixtures, up to engine blocks a new, agitating dip type washing machine named the A-F "*Surg-A-Flow*" has just been introduced by The Alvey-Ferguson Co.

The work tray is operated by a large capacity air cylinder, with one simple control. It is a single moving assembly. No motor is required. No electrical connections needed, except when the solution tank is heated electrically.

**E—315. Barrel Finishing Machine**—Capacity and precision control for large parts finishing, deburring and polishing operations are claimed for the Model V36 barrel finishing machine. The unit offers 36 by 48 and 36 by 64-in. barrel sizes with up to 40 cu ft total capacity. One- or two- compartment barrels fit specific needs. Variable speed controls permit adjusting tumbling rates from 7 to 21 rpm.

Floating power drive, using a Rampe developed belt-and-gear power transmission system, provides smooth start-stop and quieter operation with reduced stress. Magnetic brake motor with remote and overload protection is provided.

**E—316. Paint Stripper**—Quick Strip No. 5 is a new, non-inflammable alkaline organic solvent type paint stripper which is designed to first wrinkle paint, enamel or lacquer coatings and then allow the wrinkled coatings to be flushed off with water. It is claimed to strip a variety of types of paint coatings, including many epoxy-resin type coatings which have posed a very difficult or almost impossible stripping problem in the field.

It is used as received at room temperature and can be used in steel tanks or containers over prolonged period of times without attacking the metal.

Quick Strip No. 5 is also formulated to slow down considerably the evaporation of solvents and contains inhibitors so that the metal surface after the paint has been stripped will have nominal rust protection prior to painting. It is a product of The Mitchell-Bradford Chemical Co.

**E—317. Phosphate Coating**—"Heatbath Corp. has introduced a new product, Morphos, for simultaneous cleaning and phosphating of iron and steel articles in spray washing machines. It is claimed to produce an amorphous-type iron phosphate coating, a base for paint to prevent chipping and peeling, increase adhesion, localize corrosion should painted parts become damaged, increase over-all resistance to corrosion and to produce a more attractive finish with less paint. Morphos is a powder and used 1 to 3 oz/gal water. Time of treatment varies from 30 seconds to 2 minutes."

**E—318. Spray Booth Purgant**—The DuBois Co., Inc. has announced a new product, Perj, believed to be the first of its kind of purging water curtain paint spray booths. Perj, when used periodically, reduces clean-up time measurably, according to the announcement. This product contains no corrosive solvents, and is safe on ferrous and cuprous metals.

**E—319. Portable Demineralizer**—New portable demineralizers are now available which will provide chemically pure water equal to 15 distillations in quartz, the Culligan DI water department has announced.

The units, which connect at any plant water tap, will be furnished on a rental basis and will be maintained and serviced.

Culligan officials say the units can provide a dependable, uniform quality supply of demineralized water up to 40 gal/min.

In the plating field the units can be used to maintain high quality final rinse water thus eliminating hand polishing or buffing caused by water spots. The water can also be used to make up plating baths.

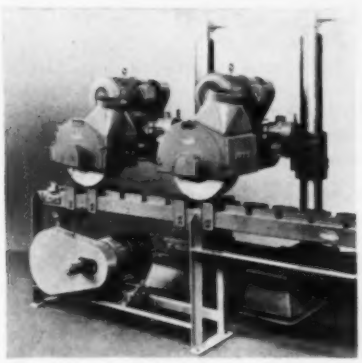
**E—320. Aluminum Hard-Coat**—A new way to hard-coat aluminum parts claimed to be ten to fifty times faster then conventional methods has been announced by Toro Manufacturing Corp.

The process, result of a four-year search at Toro's Research and Development Center for an abrasion-resistant aluminum reel, also challenge older hard-coating methods with greater electrical efficiency, reduced refrigeration requirements and lighter color of the end product, Toro officials claim.

The heart of the new process is its ability to utilize very high current densities without "burning" the aluminum. Where other methods employ current densities between 25 and 100 amp/sq ft, the Toro system is able to increase this level 20 to 40-fold.

These high current densities, in turn, permit greater speed in anodizing parts. Ordinary processes require between ten and 50 minutes to build a protective surface coating of 0.001 in. The Toro process does the same job in one minute.

As a result of this extremely brief exposure to the acid of the electroylte, the coatings produced are light in color, ranging from a silver gray to a medium gray as contrasted with the black and dark gray obtained by usual methods. These lighter coatings make dyeing possible in a wide range of colors.



**E—321. Buffing and Polishing Machine**—A new low-cost Acme, straight-line buffing and polishing machine for high-production, light-duty operations is announced by Acme Manufacturing Co. The machine is adapted to the finishing of such parts as nameplates, door handles, drawer pulls, channel extrusions, small moldings, hinges, cigarette lighter bodies, refrigerator shelves and ornaments.

The machine consists of a 10-in. wide, 8-ft long conveyor unit and suitable Acme adjustable lathes that perform the buffing operations. Additional conveyor sections can be added when finishing requirements call for more lathes.


# SETHCO 'In-Tank' PUMP Outside FILTER SYSTEM

**offers universal, self-priming, maintenance-free, leakproof operation**

**COMPLETE CHEMICAL RESISTANCE AND FULL-VIEW FILTRATION UP TO 250° F.**

Filter pumps were not meant to be submarines. SETHCO detachable filter chambers are always outside the tank for full-view filtration, for swift cartridge cleaning without disturbing tank operation. SETHCO 'In-Tank' Pumps can be positioned just below liquid surface or can be equipped with extension strainers to filter at any level from tank bottom up. Pumps can be used for agitation or transfer. Harder working ½ or ¾ hp motors can accommodate all size filter chambers by throttling from open pumping capacities of 900 and 1800 gph to filter chamber capacities of 50 to 1200 gph.

SETHCO 'In-Tank' epoxy pumps are rugged and chemical resistant. They are available with Type #316 S.S., Hastelloy, titanium or epoxy glass pump shafts. Filter chambers are high temperature lucite or epoxy. SETHCO fully guaranteed filter systems are furnished complete, ready for immediate use.

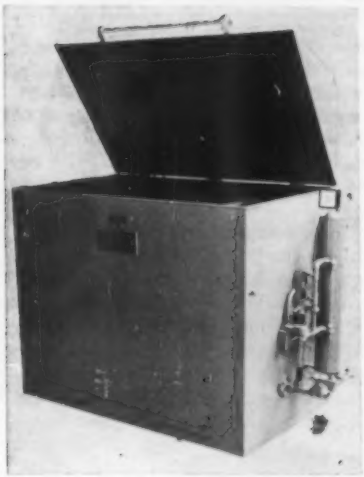
*Write for Spec. Sheet No. 7518 and Complete Catalog No. M-1*

**Sethco**
MANUFACTURING CORP

2290 BABYLON TURNPIKE, MERRICK, L. I., N. Y. • MAyfair 3-4220

DEPTH FILTRATION FOR ALL ELECTROPLATING AND INDUSTRIAL APPLICATIONS • METAL FINISHING • PHOTO PROCESSING • PETROLEUM • SOLVENTS • LACQUERS • PHARMACEUTICALS • ULTRASONIC CLEANERS • RADIOACTIVE SOLUTIONS • WATER • ELECTROTYPING

# TRADE LITERATURE



**L—301. Corrosion Test Cabinet**—Newly designed accelerated corrosion testing equipment is described by Industrial Filter & Pump Mfg. Co. in its Bulletin No. 140.

The custom salt fog, humidity test cabinet design is a self-contained unit requiring no extra auxiliary tanks, mixers, pumps or auxiliary apparatus . . . all components are contained in a "packaged" unit, say the manufacturers.

Designed in sizes to accommodate test specimens, panels or entire product in simulated environments, the cabinets meet requirements of most federal and commercial test specifications.

Standard size or special size test cabinets to conduct CASS, Corrodkote and other accelerated environmental tests requirements are designed and built to rigid specifications.

**L—302. Abrasive Finishing**—A new data sheet containing detailed recommendations for producing selected finishes on carbon and stainless steels has been made available by The Lea Manufacturing Co. Finishes described in detail on satin finishes, Butler finishes and bright finishes. Information includes abrasive compound recommendations, wheel speeds and types of buffs. There is also a section on blending and simulating mill finishes on stainless steel for blending in weld marks and for the removal of tool and die marks.

**L—303. Water Treatment**—Methods for automatic control of water treatment plants are discussed in Technical Reprint T-179, available from Graver Water Conditioning Co. Entitled "Instrumentation for Water Treatment Plants," the reprint contains two parts.

Part I deals with control of demineralization plants and covers a wide range of subjects including "stepless" regeneration, quality control of effluent, conductivity, *p*H control, automatic regeneration, and the use of multiport and piston-operated valves. Part II considers control of cold process softening and clarification units, hot process-hot zeolite systems and sodium zeolite systems.

**L—304. Gold Plating**—New paper, 6 pages describing metallurgical properties, operational data, and uses of a patented acid-type industrial gold electroplating formulation, trademarked Autronex, is offered by Sel-Rex Corp.

The technical exposition covers the composition of this low *p*H gold formulation for industrial applications. Deposit characteristics, corrosion resistance, equipment requirements, solution makeup and maintenance, gold consumption, trouble shooting, analytical procedures, metal content chart—all are carefully outlined.

**L—305. Vibratory Finishing Machine**—A new, low-cost vibratory type finishing machine is described on Form No. C-35-S Almco, Queen Products Division, King-Seeley Corp.

The new Model VT-72 Vibrasheen is said to offer the advantage of vibratory finishing of metal parts—such as deburring, descaling, cleaning, burnishing, and surface refinement—at reduced time cycles as compared to ordinary barrel finishing equipment. The new unit has a 2.5 cu ft capacity and has a standard vibrating frequency of 3380 cycles/min.

Illustrating the efficiency of the new model Vibrasheen, Almco states that the VT-72 activates 100 per cent of the parts and media in the tub.

**L—306. Liquid Cleaner**—Kelite Formula 28, U. S. Patent No. 2381124, a multipurpose liquid cleaner is described in a new bulletin by Kelite Corp.

The bulletin describes how Formula 28 removes grease, oil, ink, soot, dirt, light carbon and similar deposits from hard surfaces without heat, fumes or fire hazard. It is claimed to be safe for use at room temperature, by spray, wipe-on or immersion method, on commonly used metals, plastics, Plexiglass, rubber, porcelain, wood and painted surfaces.

As well as being a machinery-equipment cleaner, it is used as a preliminary degreaser prior to alkaline cleaning and before pre-spotweld etch.

**L—307. Portable Filters**—Two recently introduced plating filters feature compactness and mobility. They are described in Industrial Filter and Pump Mfg. Co.'s Bulletin 118.

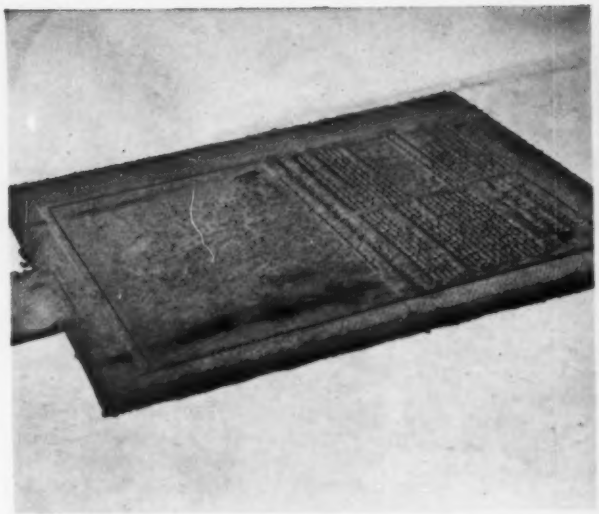
In the announcement on page 1410 of December 1959 PLATING it was stated that one of the type 118 filters "has 600 square feet of filtration area." This figure should have appeared as 30 square feet.

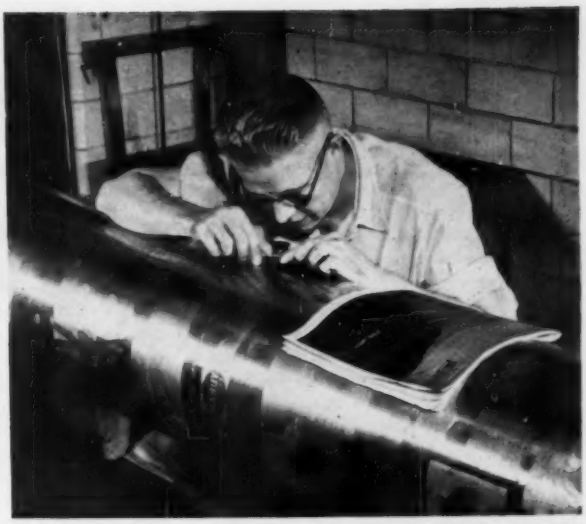
**L—308. Aluminum Enameling**—A new guidebook on the application of porcelain enamels to aluminum has just been published by Reynolds Metals Co.

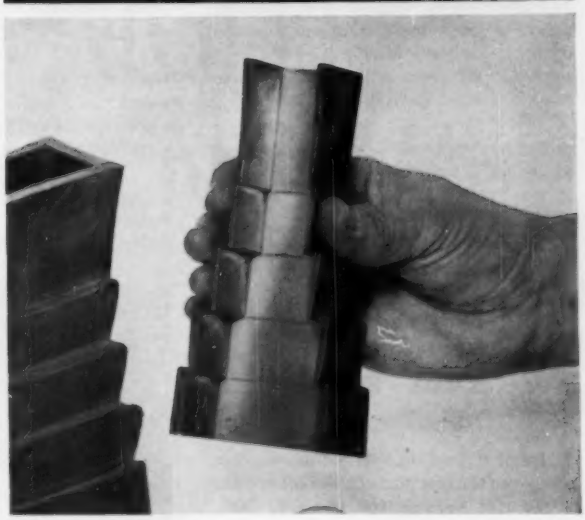
The 22-page book, "Porcelain Enameling of Aluminum," which contains several illustrations in color, covers alloy selection, metal preparation, choice of frit, slip formulation, enamel application and firing.

**L—309. DC Power Supplies**—Rapid Electric Co., Inc. has issued a new brochure covering its new line of regulated dc power supplies. The illustrated literature contains models available, component data, features and applications.

**L—310. Ventilating Equipment**—A new bulletin describes Heil Rigivin (rigid vinyl) and Rigidon (reinforced plastic) collecting hoods, ducts and stacks, elbows and other fittings; includes listing of standard sizes, specifications and chemical resistance data. It enables purchasers to lay out a completely corrosion resistant system for handling corrosive fumes—using standard parts.







# In electrotyping, plating rotogravure rolls, electroforming, "Plus-4" Copper Anodes cut plating costs

**ELECTROTYPERS** have discovered that, in addition to eliminating the use of bags and diaphragms, they can place "Plus-4" (Phosphorized Copper) Anodes closer to the cathodes to speed up the plating cycle 30% or more with the same power input – and still obtain a smooth deposit. As an alternate, power can be reduced by one-third with an equal reduction in resistance and generation of heat to obtain finished electros in the same plating time. This is an important advantage when thermoplastic plates or molds are used and tanks must run no higher than 95F.

**MAKERS OF ROTOGRAVURE ROLLS** have found that "Plus-4" Anodes provide a much finer, smoother surface for polishing and etching, and retain the quality of the light tones in runs of over one million impressions on a single set of design cylinders.

In addition, they report significant reductions in cost. One publisher found that he produces superior rolls with less labor and a reduction of 18 to 20% for materials required in the plating process. Another reports he gets a dividend of eight extra rolls for each tank load of "Plus-4" Anodes. And still another has found a 15% saving in over-all costs.

**IN ELECTROFORMING** operations, "Plus-4" Anodes – by eliminating the most prevalent acid-copper plating difficulties – have made it practical to produce many new products. Their ability to provide a smooth, dense deposit relatively free from growths and blemishes made possible relatively thick shells for molds used in making rubber and plastic articles, and in intricate precision parts for electronic use. Electroformers report operating economies similar to those found in the graphic arts field.

**WRITE FOR INFORMATION** on how you can obtain a test quantity to supply one tank. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass, Ltd., New Toronto, Toronto 14, Ontario. 88104

## ANACONDA®

**"PLUS-4"® ANODES** Phosphorized Copper

*Made by The American Brass Company*

# PERSONALS

**RONALD W. GREINER** and **GERALD L. SWARTZ** have received appointments as salesmen for American Buff Co., Chicago.

Mr. Greiner, who will represent the company in Southeastern Michigan, was in the engineering and estimating section of a Detroit plating and metal finishing equipment manufacturing company for 5 years. A graduate of the Detroit Institute of Technology, he holds a BS degree in chemistry.

Mr. Swartz, who will service the New England area, for the past 5 years has been proprietor and manager of an appliance center in Ypsilanti, Michigan. For 7 years prior to this, he was traffic department general foreman for Kaiser-Fraser Corp.

G. L. Swartz

J. E. Trankla

**JOSEPH E. TRANKLA** has been appointed to the new post of assistant general manager of Anadite, Inc. of South Gate, California. Mr. Trankla, credited with developing many of the new skills and techniques for hard anodizing of aluminum, was for the last four years director of research and development for the Anachrome Corp., an affiliate company of Anadite, Inc.

●

**MARTIN F. WILKERSON,** branch manager of Diamond Alkali Co.'s Southwest district sales office has been promoted to sales manager, Chlorinated Products Division, Cleveland, O.

Mr. Wilkerson has 11 years of sales experience with Diamond. He holds a bachelor's degree in business administration from the University of Tennessee and attended City College of New York.

**ROBERT L. WALKER,** salesman for the Southwest District Sales Office was promoted to the branch manager's position, replacing Mr. Wilkerson. He has been a salesman for Diamond in Houston for almost eight years, transferring there from Painesville, O.

He holds a bachelor's degree in science and economics from Youngstown College.

**A. J. FISHER JR.** has been elected executive vice president of Metal & Thermit Corp.

Mr. Fisher joined M & T in 1955 as a member of the market research development department. He was appointed general sales manager in 1956. In 1958, he was named general manager of the newly formed Welding Products Division.

Prior to his association with M & T, he was manager of chemical sales development for U. S. Industrial Chemicals, Inc., New York, and president of U. S. Polymeric Chemicals, Inc., Stamford, Conn. He is former secretary and a director of the Chemical Market Research Association, and also former secretary and a director of the Commercial Chemical Development Association.

Mr. Fisher is a native of Rochester, N. Y. He was graduated from Phillips Exeter Academy in 1932, and received his Bachelor's degree in chemistry from Princeton University in 1936.

A. J. Fisher Jr.

H. W. Buchanan

**HARRY W. BUCHANAN** has been named a vice president of Metal & Thermit Corp. Mr. Buchanan will retain his present assignment as manager of the general sales department. He is responsible for the direct selling and distribution of manufactured products, including supervision of regional managers.

Previously he was sales manager for M & T chemicals, metals, and plating products. He joined the company in 1947 as a chemical engineer.

He received the BS degree in chemical engineering from Rensselaer Polytechnic Institute, and the MS degree in industrial management from Massachusetts Institute of Technology on a Sloan Fellowship.

He is a member of the Society of the Plastics Industry, Society of Plastics Engineers, American Electroplaters' Society, American Chemical Society, and the Chemists' Club.

**RICHARD MC DOWI LL** has been named technical sales representative by Frederick Gumm Chemical Co. in southern and northwestern Ohio. The new sales territory will include the cities of Cincinnati, Columbus, Toledo and Dayton.

Mr. McDowell will maintain offices at 3854 Kenswick Lane, Dayton. A member of the American Electroplaters' Society with 15 years of experience in the metal finishing field including production and job shop plating and barrel finishing, for the past six years he has been active as a technical service representative in this area.

R. McDowell

J. E. Eisele

J. Shockcor

H. V. McGuire

**JOSEPH R. EISELE** has been promoted to district sales manager by Enthone, Inc. of New Haven, Conn. Mr. Eisele will manage Enthone's newly created Middle Atlantic sales territory and will direct the activities of three district sales engineers. The new territory will include New Jersey, eastern Pennsylvania, Delaware, Maryland, the District of Columbia and Virginia.

Mr. Eisele joined Enthone in 1948 and has served as sales engineer for New Jersey and a portion of eastern Pennsylvania since that time. Previously he was employed as a plating chemist at the General Electric plant in Bridgeport, Conn. He holds the degree of Bachelor of Chemical Engineering from Rensselaer Poly-

## *Corrosion resistance increased up to 500% by M&T's "DUPLEX CHROMIUM"*

By adding only a few minutes more plating time, you can add *years* to the life of chromium plated finishes in outdoor exposure.

Using M&T "DUPLEX CHROMIUM" to increase chromium thickness approximately 5 times from the usual average of 10 millionths of an inch enables exterior parts to maintain an ASTM durability rating of 8 or better (10 is *perfect*)!

This thicker and more uniform chromium plate radically increases survival time in modern, severe, accelerated corrosion tests. Parts with ordinary chromium fail within 36 hours in CASS tests, or 2 cycles in Corrodkote tests. They survive four times longer when plated with 50 millionths of an inch M&T "DUPLEX CHROMIUM" ... and over *ten* times longer with 100 millionths.

**NOW IN AUTOMOTIVE PRODUCTION**

M&T's "DUPLEX CHROMIUM" is now producing superior results for automotive trim. On window ventilation frames, it is depositing in the same production time a *minimum* 30 millionths of metal in *recessed* areas. On back up light sections, the M&T Chromium ranges from 60 millionths minimum to 140 millionths maximum—a 1 to 2 variation as against *insufficient minimums* and 1 to 12 variation with ordinary chromium. Door sash channels previously plated with ordinary chromium ran only 16 hours in the CASS test before failure; with "DUPLEX CHROMIUM", they go 128 hours without failure.

Get the full, important details. Send for an M&T plating engineer to explain—or for technical paper. METAL & THERMIT CORPORATION, General Offices: Rahway, N. J.

M&T **plating products**

In Canada: Metal & Thermit—United Chromium of Canada, Limited, Rexdale, Ont.

technic Institute and is a member of the Newark Branch, AES and the Rensselaer Club of New Jersey.

**JOE SHOCKCOR** and **HUGH V. MCGUIRE** will assist Mr. Eisele as district sales engineers. Mr. Shockcor will handle east central Pennsylvania and the southern part of the territory. Mr. McGuire will serve the northern New Jersey district.

Mr. Shockcor has been with Enthone since his graduation from Lehigh University in 1950 with a BS degree in chemical engineering. He worked for two years as research chemist in the Enthonics Laboratory before becoming a sales engineer in the Pennsylvania area. He is a member of the Lancaster Branch, AES and a delegate to the Supreme Society.

Mr. McGuire is a graduate of Rutgers University and has had 14 years experience in metal finishing. He joined Enthone in 1958 as assistant to the sales manager. He was formerly employed by Hanson-Van Winkle-Munning Co. as manager of general equipment sales. He is a member of the Newark Branch, AES.

●

**SHELBY A. DAVIS** has been named sales manager of its Coatings Division, U.S. Stoneware Co., Akron, and also of the Coatings Division of its affiliated company, Chamberlain Engineering Corp.

Mr. Davis has been a member of U.S. Stoneware's sales department since 1955. For five years previously, he was with the W. J. Ruscoe Co. He is a graduate of Akron University.

S. A. Davis

G. F. Doria

**GABRIEL F. DORIA** is now technical representative of The U. S. Stoneware Co. Mr. Doria works out of U. S. Stoneware's New York City offices, 60 East 42nd St.

A graduate in chemistry of Seton Hall University, for the past three years Mr. Doria has been a sales engineer for Graver Water Conditioning Co. Previously, he had served as a chemist with Bennett's Chemical Distributors Co. and had worked in laboratories of Tide Water Associated Oil Co. and Dodge & Olcott Co.

●

**EDWARD E. ANDERSON,** vice president in charge of West Coast operations, Metal & Thermit Corp. has retired. Mr. Anderson has been responsible for the company's San Francisco manufacturing operations, and for the sale of chemicals, electroplating materials, and welding equipment on the West Coast since 1941.

Son of a New Jersey farmer, Mr. Anderson studied business administration with money saved from his first job as a railroad telegrapher. He joined M & T in 1914. He moved to South San Francisco in 1920 as chief clerk, becoming office manager in 1924. He took charge of that plant and all West Coast operations in 1941, and was elected a vice president in 1955.

●

**ALBERT E. SAKAVICH** has been appointed to the staff of the advertising department, Metal & Thermit Corporation.

Mr. Sakavich, a graduate of Penn State University, was previously staff assistant to the executive vice president and marketing director of Kelite Corporation, a manufacturer of industrial chemicals. He also worked as publicity director and an instructor in journalism at Penn State.

Mr. Sakavich and his family reside at 51 Dellmore Ave., Berkeley Heights, N. J.

●

**DR. RALPH A. SCHAEFER,** director of research and development at The Bunting Brass and Bronze Co., has been named director of an enlarged department of engineering and research. Dr. Schaefer will be in charge of research development, processing engineering and inspection functions of the company.

●

**DAVID C. SPAULDING,** currently manager of product engineering, has been promoted to the position of assistant director of the enlarged department.

Dr. Schaefer was recently elected president of the Electrochemical Society, Inc. for the 1960-61 term and will take office in May 1960. He has been active in The American Electroplaters' Society and served as president in 1954-55, and has been active at the committee level in other national professional groups.

Dr. Schaefer came to Toledo a year ago from the position of technical advisor to the president of the Cleveland Graphite Bronze Division of the Clevite Corp.

●

**FRANK M. MACIOCE** has been appointed regional sales manager of Industrial Filter & Pump Mfg. Co. With Industrial ten years as a sales engineer, Mr. Macioce has been engaged in the design of ion exchange and waste treatment equipment.

Macioce is a graduate of the College of the City of New York where he received his BS degree in 1934 and his chemical engineering degree in 1935. He is a member of the American Chemical Society and the Central States Sewage and Industrial Waste Association. Prior to his association with Industrial, Macioce was on the engineering staff of American Cyanamid Co.

F. M. Macioce

C. M. Weege

**C. M. WEEGE** has been named regional sales manager of Industrial Filter & Pump Mfg. Co. Mr. Weege graduated from the U. S. Merchant Marine Academy and received a commission in USNR in 1947. After serving 14 months in Korea, he studied philosophy and marketing at Depaul University while being employed as sales representative by Remington Rand, Inc. of Chicago.

He later served as assistant manager and branch sales office manager at San Francisco offices of C. E. Church Division of American Radiator Standard Sanitary Corp.

●

**ROBERT F. POYTON** has recently been appointed as sales and service representative in the New England area by the Neilson Chemical Co. The above appointment was made as a result of an expansion program in both plant facilities and staff.

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### HAROLD M. SHONBERG

Harold M. Shonberg, president of Alpha Metals, Inc., Jersey City, N. J. and the Alpha-loy Corp., Chicago, Ill., was one of five people killed Saturday, Dec. 5, at Palm Desert, California, when the small plane in which he was being given a demonstration flight so that he might consider purchasing it for his company, collided in the air with another private plane. He was 49.

All four occupants of the other plane were killed. The pilot and other occupant of the plane in which Mr. Shonberg was a passenger were hospitalized.

Mr. Shonberg travelled extensively for business reasons and had been in California for several days seeking a location for a larger branch plant.

Mr. Shonberg started his firm in 1930. He had previously taken over I. Shonberg, Inc., a company founded by his grandfather in 1871 as a metal refinery then reorganized by his father, in 1912, as Standard Rolling Mills, Inc.

Surviving are his widow, two daughters, his mother, a brother and a sister.

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**Remittance must accompany all book orders placed with AES Headquarters.**

**Die Geschichte der Galvanotechnik (The History of Electroplating),** by O. P. Kraemer, R. Weiner and M. Fett, 123 pages, 1959. Published in German by Eugen G. Leuze Verlag, Saulgau/Wttbg., Germany, price about $2.25 direct from publisher.

This is the first volume of a series of hard covered booklets being published by the German magazine "Galvanotechnik" (Electroplating), formerly Metallwaren Industrie und Galvanotechnik, partly in commemoration of their 50th year. A special extra issue of the magazine also appeared in January, 1959, which is likewise of considerable interest to historians of electroplating.

Three volumes have already appeared in the new series,and a fourth is imminent. The second volume was "Vom Hand-und Automatenpolieren" (Hand and Automatic Polishing), by W. Burkart, 109 pages, 1959. The third volume which has just appeared is "Schnellanalysenmethoden fuer galvanische Baeder" (Rapid Methods of Analysis for Electroplating Baths), by R. Weiner and C. Schiele, 115 pages, 1960.

The complete series is under the very capable editorship of "Professor Dr.-Ing." Robert Weiner. The additional volumes in press or in preparation are as follows:

"Die Pruefung Metallischer Ueberzuege" (The Testing of Metallic Coatings), by A. Kutzelnigg.

"Galvanische Edelmetallueberzuege" (Electrolytic Noble Metal Coatings), by J. Fischer.

"Reinigung und Entfettung" (Cleaning and Degreasing), by A. Pollack and P. Westphal.

"Glanzverchromen und Hartverchromen" (Bright Chromium Plating and Hard Chromium Plating), by R. Weiner.

"Die chemische Oberflaechenbehandlung von Metallen—Anorganische Schutzschichten" (The Chemical Surface Treatment of Metals—Inorganic Protective Coatings), by W. Wiederholt.

"Trommelverfahren und Kugelpolieren" (Barrel Treatment and ball Burnishing), by M. Dreher.

The volume under review is the most detailed history of electroplating that the writer recalls, and makes very pleasant


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reading indeed. Georg Langbein (1849–1909), Wilhelm Pfanhauser senior (1843–1922) and others, step down from the pages of history and discuss their problems and accomplishments with the reader. Dr. Langbein is revealed as a young chemist who received his PhD from the University of Leipzig at 20, had himself declared of age, and went to Peru in South America for 10 years where he succeeded in developing a process for the recovery of iodine from saltpeter. Returning to Germany about 1879, he established a private laboratory for electrochemical investigations, and founded Dr. G. Langbein & Co. in 1881. In 1886 he printed the first edition of his book, which passed through nine American editions up until 1924, when it might be said to have been supplanted by Blum and Hogaboom. Several generations of American platers relied on "Langbein" as their principal textbook, probably without any knowledge of what manner of man the author was.

Wilhelm Pfanhauser senior (1843-1922) also wrote an outstanding German textbook, the first edition of which appeared in 1878. On account of the death of his father, he discontinued his education and engaged in the sale of photographic chemicals and supplies when about 19 years old. This took him to Vienna, Berlin, Florence, and Milan; but on February 1, 1873 he established his own business in Vienna, and this later (1907) was combined with Dr. G. Langbein and Co. to form the present Langbein Pfanhauser Werke A.G. It appears that Pfanhauser senior bought nickel salts in Paris in 1873 and introduced the new nickel plating in Germany. This would indicate that nickel plating failed to develop in Germany in 1870, when Isaac Adams Jr. was said to have introduced it successfully in England, France and Austria.

The history under review is divided into three parts, an introduction covering early electrochemical developments, electroplating in the 19th century, and electroplating in the 20th century. While this division has a point, it also has its disadvantages and causes some confusion. Thus the history of copper or nickel deposition, or equipment developments, appear in at least two widely separated places in the book, and it is necessary to search both for a given bit of information. Good author and subject indexes are provided, however, which help to bridge this gap.

The book has a large number of fine and unusual illustrations, and is a mine of detailed information on the various processes right up to the present. It originated in manuscripts by Kraemer and Fett, and has been well edited and rounded out by Dr. Weiner. As a result it includes an extensive bibliography of Dr. Weiner's publications and patents, many of which have been lost in World War II obscurity.

While a very complete history of electroplating is given, and the picture drawn is on the whole quite accurate, it is nevertheless rather strongly confined to the German outlook, and as seen through German eyes. Thus chromium plating is developed without mention of Sargent, Schwartz, Eldridge or Udy, and Fink is only discussed briefly as having a patent similar to Liebreich's.

The book partially reflects the information available in other textbooks, and sometimes has similar shortcomings. Thus the beginnings of cyanide copper plating are shrouded in mystery, as is almost universally true. It would seem that the authors might have delved into this mystery instead of weakly ascribing the first cyanide copper deposition to the American patent 34,640 of March 11, 1861 of M. Miller Jr. of Vienna, Austria. It appears to the reviewer that cyanide copper plating was probably discovered by Baron de Ruolz of Paris, who described this and many other cyanide baths in Comptes rendus *13*, 998–1021, November 29, 1841. Tommasi, in his "Electrochimie", 1889, page 280, gives August 27,

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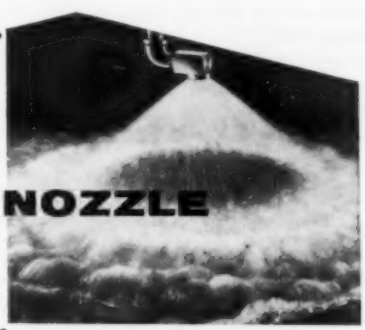

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1841 as the date of Ruolz's French patent on cyanide copper baths.

All criticisms aside, the book is a veritable gold mine of information on both the beginnings of various processes, and recent practice. Thus the last forty pages cover bright and high-speed baths, anodizing processes, and electropolishing. In view of the very low price and excellent quality in all respects, the book should be a must for libraries and practitioners the world over, even though in the German language. Electroplating is itself an international language to its more ardent devotees.

GEORGE DUBPERNELL
*Technical Advisor*
*Metal & Thermit Corporation*

**The Surface Treatment and Finishing of Aluminum and its Alloys** by S. Wernick and R. Pinner, Second Edition, 1959, 607 pages + 120 tables, 204 figures. Nonmembers $13.25, AES members $11.95.

This is the second edition of a book which first appeared in 1956 and which emanated from a series of articles by the authors in "Sheet Metal Industries" and "Metal Finishing" magazines. The second edition has been enlarged somewhat, with certain out-dated material being eliminated or condensed, and new material added.

The object of the authors in this volume, as in the first edition, has been to compile the many and varied finishing treatments for aluminum alloys. These are described in considerable detail, and the abundant literature references enable the reader to pursue further a subject of specific interest. In general, the authors have presented the material without critical comment. A very thorough Table of Contents, with headings and sub-headings, shows what each chapter covers and enables the reader to survey quickly the various phases of a particular field. Over a third of the book has been devoted to anodizing and related problems, approximately one-sixth to plating on aluminum, another sixth to electrolytic and chemical methods for cleaning and polishing, and the remaining third to mechanical treatments, organic finishing, vitreous enameling, metal spraying, and corrosion.

The anodizing chapters are well done, showing a nice balance between theory and practice. Recent interest in hard coating, bright anodizing for automotive trim, and evaluation of anodic coatings have received adequate recognition. However, the large field of anodizing for architectural applications has not been covered specifically.

Some chapters have an emphasis which perhaps reflects European interest and practices as contrasted to American. For example, a large number of pages are devoted to the M.B.V. and E.W. type chemical coatings, which now find very little application in this country. Likewise, there is an entire chapter on the Vogt process for plating on aluminum, which is not well known in the United States but apparently widely used in England.

This is the only English language book of its type and performs a tremendous service in assembling widely scattered information under one cover. No less important, it does an excellent job of supplying literature references for this material. American workers, who are often handicapped by a language barrier in keeping abreast of developments from abroad, will find it especially beneficial for surveying German, French and Russian developments in this field. The book should prove invaluable for all those concerned with developing finishing treatments for aluminum.

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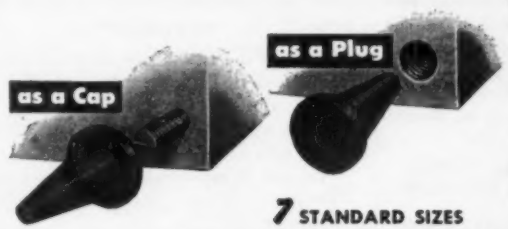


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# BRANCH NEWS

Total AES Branches U. S., Canada, Australia, March 1, 1960—58.

## BLUE RIDGE

### Henry Strow on Brass Plating

The Blue Ridge Branch met Jan. 8 at the Polo Grill in Winston-Salem, North Carolina, **Dr. Nelson F. Murphy** presided. Two new memberships were announced.

**Henry Strow** delivered a most educational and practical discussion on Brass Plating. To hear the Yankee brass plating authority, 31 people poured in from Blacksburg, Virginia; High Point, Winston-Salem, Greensboro, Statesville, Charlotte and Mount Airy, North Carolina; and other guests from St. Petersburg, Florida and Stratford, Connecticut.

Enthusiasm was electric as members and guests fed questions to the speaker and the speaker responded as rapidly as the next question came in—it was a real Blue Ridge-type meeting. It was announced that the Branch will meet in Greensboro on Feb. 5 to hear a speaker from Interchemical Corp. on organic finishing, and another plant tour is planned in March for Sperry-Farragut in Bristol, Tennessee.

**Robert H. Probert**
*Secretary*

## BOSTON

### Narcus Discusses Plating on Plastics

Boston Branch met Thursday, Oct. 1, 1959 at the Hotel Statler Hilton with President **Hubert H. Foley** in charge. The Headquarters' letter concerning reprints of 'Milestones of AES' was read. **Manson Glover** reported on the business sessions at the Detroit Convention. It was announced that November would be "New Members Night" with a buffet served afterwards. Discussion as to dates for the 1960 Annual Meeting led to a vote accepting the date of Sept. 17 subject to change to October or November if the opportunity arose.

Mr. **Gagnon** announced a 1961 Convention Committee Meeting for Thursday, Oct. 22. Election of delegates and alternates resulted in the election of **George P. Swift,** Louis V. Gagnon and Manson Glover as delegates and **Hubert H. Foley, George J. Marotta** and **John R. Wright** as alternates. There were no suggestions for proposals for Honorary Membership and **Dr. Harold A. Narcus** was proposed for the Scientific Achievement Award. **Bob Pierce** then introduced Dr. Narcus, discussing "New Developments in Plating on Ceramics and Plastics." Most of the older methods were mentioned and then the chemical reduction methods for copper and nickel in more detail. Slides were used showing many of the applications for printed circuits and metal evaporation. New developments of metalizing polyethylene was discussed and actual samples shown.

**George P. Swift**
*Secretary*

## BOSTON

### Swift Moderates Panel of Diggin, Sanders, Marino, Innes

Boston Branch met Thursday, Nov. 5, at the hotel Statler-Hilton with president **Foley** in charge. Communications were read concerning the Los Angeles meeting and *Products Finishing* competition for Paper Awards. Four applications for membership were accepted.

**Bob Pierce** presented the panel consisting of **Myron Diggin** of Hanson-Van Winkle-Munning Co., **Harry Sanders** of Enthone, **Daniel Marino** of Western Electric and **William Innes** of MacDermid, Inc., with **George Swift** as moderator.

Questions started right away on the subject of trichlorethylene and a new member of the Branch, **George Rears, Jr.** of Du Pont was drafted to explain the happenings together with a comparison with perchlorethylene. Pickling of steels and special alloys, color matching of conversion coatings together with a discussion on when to use phosphates and when chromates as the prime corrosion preventative were the high points of the meeting. With plenty of discussion the meeting lasted until 10:00 p.m. when it was adjourned for beer, Cokes, coffee sandwiches and dessert served by Boston Branch on 'New Members Night'.

**George P. Swift**
*Secretary*

## BOSTON

### Stiller on Anodized Aluminum

Boston Branch met Thursday, Dec. 3, at the Hotel Statler-Hilton with President **Foley** in charge. Three new members were elected and **Lou Gagnon** announced the next meeting of the 1961 Convention Executive Committee. **Bob Pierce** presented **Frank Stiller** of Sandoz Chemical who discussed the Dyeing of Anodized Aluminum.

This presentation was read rapidly and covered a lot of ground in a short time. Pretty much every phase and type of dye was mentioned ranging from basic good alloys, mediocre alloys, poor alloys, effect of alloying elements, type of coating, vacuum deposits, pretreatment cycles, colors, rinses, pH control, how conditions affect dye absorption and a lengthy series of dye mixtures to obtain proper color.

**George P. Swift**
*Secretary*

## BOSTON

### Metal Evaporation Presented by Farrell

Boston Branch met Jan. 7 at the Hotel Statler-Hilton with President **Hubert H. Foley** in charge. One new member was elected.

**Lou Gagnon** reported that the steering committee for the 1961 Convention had held a meeting and work was starting.

**Bob Pierce** presented **Howard Farrell,** manager of process equipment for National Research Corp. who discussed 'Metal Evaporation of Heavy Deposits.' Examples of thin deposits ranging from plastic tail lights for automobiles through arm rests, door trim, horn buttons and name plates were shown. The type of units and methods of holding the metal to be evaporated as well as the work on racks were described. Reasons for using heavy coatings and examples in use were shown through slides. After a lengthy question period in which the actual details of the necessary cleaning and finishing cycles were drawn out.

**George P. Swift**
*Secretary*

## BUFFALO

### Sample Presents Paper on Corrosion; Branch Has Booth at Science Fair

The Buffalo Branch held its Jan. 8 meeting at the Niagara Manor in Buffalo, N. Y. with 25 in attendance.

**Daniel Stachowiak** of the Sylvania Electronics Division, Buffalo, was elected to membership.

**Harold Shapiro** introduced one guest and reported on the changes in Branch membership since September.

**George Wolf,** representative to the Technical Societies' Council of the Niagara Frontier, reported that the Annual Science Fair will be held April 19–21 at the Memorial Auditorium in Buffalo, N. Y.

**BRANCH SECRETARIES**

**Branch News is required of all Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's broad readership.**

The Branch voted to sponsor a booth at the Fair with the hopes of stimulating interest in AES membership. Harold Shapiro was appointed chairman of the committee and will be assisted by George Wolf and **Paul Conn.**

**Ray Kilroy** announced that **Wally Keefe** of the Jamestown area is confined to the hospital due to a coronary attack.

The Christmas Party Committee, **Chuck Fotheringham,** chairman, **Roger Brown, Bob Eich** and **John Tiebor** were given a rising vote of thanks for staging a wonderful party.

After the business session our Librarian, **Dick Davis,** introduced the speaker of the evening, **Clarence Sample** of the International Nickel Co., whose subject was "Corrosion Behavior and Protective Value of Electrodeposited Coatings".

**King Ruhly,** sales manager of the Michigan Chrome and Chemical Co., will speak at the April meeting on "Electroplating, Rack Coating and Stop-Off Materials".

**Robert E. Lienert**
*Secretary*

## CAPITAL DISTRICT

### Saubestre Talks on Printed Circuits

The January meeting of Capital District Branch was held at the Circle Inn, Latham. After a chicken dinner attended by about 15 members, the business meeting was held with about 33 members present.

**Robert Hill** announced that **Robert Wolf, Fred Enfield** and himself were national delegates, with **Bill Allison, John Green** and **Ed LeGere** as alternates.

President Hill appointed the Spring Outing Committee with **Art Eisner** serving as chairman with Fred Enfield and Ed LeGere as aides.

After the meeting **Dr. E. B. Saubestre,** technical director of Enthone, Inc. gave a very interesting speech on "Printed Circuits". A great deal was obtained from his talk because few of our Branch were very familiar with printed circuit work.

Many guests were introduced. Among them were **John Courtemanche,** past president of Montreal Branch and now with G.E., **George Hylander** of Mid Hudson Metal Finishing, Poughkeepsie, Messrs. **Egans, Burralt** and **Etherington** of G.E., **Norm Bailey** of WMMB Radio Station, North Adams, and Mr. **Hayer** of Enthone, Inc. Also, **Mr. Leonard Crenon** of International Chemical, a long time member of our Branch attended his first meeting.

**Ed LeGere**
*Secretary*

## CENTRAL MICHIGAN

### Borlet and Winters Speak at Jan. Meeting

Central Michigan Branch met at the Hotel Hayes in Jackson, Michigan on Tuesday evening, Jan. 5.

Thirty-one members and guests attended this dinner and educational meeting.

Following dinner, a short business meeting was conducted by **D. D. Trafelet,** president.

**Chester Borlet,** national second vice president, attended and spoke on the importance of individual and sustaining membership in the AES.

The speaker for the educational meeting was **Jack Winters** of Incar, Inc. His subject was "The Anodes Side of The Story." He presented an extremely interesting subject well illustrated with slides.

**Fred Stuckenberg** of Carrier-Stephens Company won a $10.00 attendance prize.

**Homer E. Welch**
*First Vice President and Publicity Chairman*

## CHICAGO

### Brenner Presents Special Problems

The Jan. 8 meeting was a joint session of the Chicago Branches of the AES and Electrochemical Society. An overflow crowd attended the meeting at Stella's Restaurant, 3206 North Kostner Avenue. **Al Poe** reported that Frankie Masters and his orchestra and four good acts are booked for the annual banquet on Jan 30. For the first time this year, the suppliers will give a cocktail hour preceding the banquet and no one will be admitted to the room without a ticket.

**Rudy Hazucka** gave a report on a new home for our future meetings. It was decided by a majority vote to try out Petricca's, 3237 North Harlem Avenue after our plant visit to Sunbeam on April

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8. Two applications were approved and four new memberships were received for approval.

**Si Gary,** librarian, introduced the speaker of the evening, **Dr. Abner Brenner** of the United States Bureau of Standards whose subject was "Some Special Problems in Protective Metal Coatings."

The first problem was the development of a fixture to plate the inside of gun barrels with chromium. For this purpose, an angle iron which centered the inside anode and then by rotating the gun barrel during plating, a uniform plate of chromium inside the gun barrel was obtained.

The Atomic Energy Commission has a very serious problem in dealing with uranium for storage purposes and for use in atomic piles. Uranium is a very active metal and forms an oxide very rapidly. Three methods were developed to protect uranium with adherent coatings: (1) plating uranium with aluminum from an organic bath (4-10 mils thick), (2) immersion deposit of zinc from a fused salt bath, (3) hot dipping the uranium with tin or indium using a flux of lithium and potassium chlorides. The coatings were tested for porosity (1) by reacting with hydrogen or (2) by placing the plated sample in boiling water.

Dr. Brenner then discussed the hydrogen embrittlement, which causes loss of ductility of high carbon steels due to pickling and plating operations. Heavy water, deuterium, was used to cause embrittlement in the steels and could be determined by use of mass spectograph. It was found that the hydrogen present by metallurgical proceedures and that produced by plating processes were in different states of condition. To prevent hydrogen embrittlement use (1) a different type of steel, (2) use organic plating baths or (3) plate the steel with 0.0005 of nickel then follow with cadmium.

The next problem was the vapor deposition of tungsten so that it could be used to plate the nozzles of the Polaris missile. The nozzles are subjected to very high pressures and high temperatures (2500C). Tungsten has a very high melting point (3400C), high strength and its application as a material for nozzles would be very suitable. A method was developed where the tungsten, by vapor deposition, can coat the nozzles at the rate of about 1 mil per minute. He then showed a slide of other materials which were successfully coated by this method. After a question and answer period, Dr. Brenner was given a rising note of thanks for his very interesting and informative talk.

**Christopher Marzano**
*Publicity Chairman*

## CINCINNATI
### Welker Explains Buff and Compound Training

The largest technical meeting in recent years was held on Jan. 28 at the Engineering Society, with 68 members and guests present. The speaker for the evening was **Harry Welker,** senior process engineer, Guide Lamp Division, General Motors Corporation, Anderson, Indiana. The topic under discussion was "How to Train Foremen and Operators in the Most Efficient Applications of Buffs and Compounds".

Mr. Welker delved into the training techniques which are used, namely: (1) demonstrations, (2) class room discussions and instructions, (3) keep the people concerned informed of their progress, and (4) follow-up. It has been proven that when people are shown and trained in the proper techniques of buffing they will be able to do a better and more efficient job. After a person has been properly instructed he should then be kept informed as to his progress. A good method of doing this would be to make cost data of the operations available so that all concerned could see the results of their efforts.

Follow-up is necessary to make sure that the established process is the best one and that the buffs and compounds are doing their job. A spirited question and answer


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period followed. Judging by the enthusiasm of the group present, it is felt that this talk would be an asset to any Branch's program.

During the business meeting **Lee Howald** gave a brief run-down on plans for the Tri-State Meeting scheduled for April 23, 1960, Sheraton Gibson Hotel, Cincinnati, Ohio.

One active member was elected.

The group adjourned to the social hour sponsored by the Buckeye Products Company, **Chuck Wise** as host.

**David L. Kaplan**
*Secretary*

### COLUMBUS
### Winger Talks on Ion Exchange

This monthly meeting was held on Jan 8 at Battelle Memorial Institute. The business meeting included a discussion of the Tri-State Meeting to be held in Columbus in 1961, and the election of a new member.

Librarian **Hugh Miller** introduced the speaker of the evening, **Dr. Alvin S. Winger** of Rohm and Haas Co., Philadelphia, Pennsylvania, who spoke on "The Application of Ion Exchange to Plating Problems". Dr. Winger presented an excellent account of successful applications of ion exchange to waste disposal, metal recovery, and bath treatment. His treatment of the stability of resins, the so-called poisoning of resins by some salts, and the economics of their use added much to the value of his talk. In the question period which followed, Dr. Winger commented on the status of permselective membranes as regards their manufacture and industrial use.

The meeting was adjourned following an interesting movie on Basic Electricity done in cartoon-style by Walt Disney Studios. Refreshments were served following the meeting.

### DENVER
### Leveld Copper Plating Presented by Marcum

The January meeting was held at the Oxford Hotel on Jan. 15. Before dinner an executive meeting was held and **Bob Martin,** president gave a report on the proceedings of a meeting in Fort Worth, Texas concerning the formation of an AES Regional Group in the Southwest Area. The dinner was attended and enjoyed by 24 members. The regular business meeting was held following a short recess. The election of a new member was announced.

## CINCINNATI TO HOST TRI-STATE REGIONAL

An expanded educational program will highlight the Sixth Annual Tri-State Meeting of the AES. Morning and afternoon sessions will be a new feature for this meeting which will be held on Saturday, April 23, at the Sheraton-Gibson Hotel in Cincinnati. The interesting educational program planned is expected to bring out more operating and technical personnel than have attended any previous Tri-State meeting, according to Lee J. Howald, Harshaw Chemical Company, general chairman.

David L. Kaplan, Electric Auto-Lite Company, is chairman of the committee planning the educational sessions. AES National President Ralph D. Wysong, Studebaker-Packard Corporation, will be Honorary Chairman.

"Personnel in Plating" by Robert L. Giesel, president, Adolph Plating, Inc., Chicago, will be the first paper followed by "Corrosion Resistance of Decorative Plates" by James D. Thomas, General Motors Research Laboratories, Detroit.

That afternoon, "Waste Disposal" will be presented by George E. Barnes, Case Institute of Technology. "A Visit to Moscow" by Dr. Abner Brenner, chief of the Electrodeposition Section, National Bureau of Standards, Washington, D. C. will conclude the program. Dr. Brenner will describe his visit to the Soviet Union, where he attended the Conference on Protection and Corrosion of Metals. Most of the illustrated talk will be non-technical and will be concerned with general impressions.

The Tri-State Region of the AES includes the Cincinnati, Dayton, Indianapolis, Louisville and Columbus Branches, one of which is host each year for the annual meeting. More than 300 platers and suppliers are expected to attend the meeting, which will conclude with an evening cocktail party sponsored by suppliers, and a dinner dance. The ladies will socialize in the hospitality suite hosted by the Cincinnati Branches while their men attend the educational sessions.

Another innovation at this year's Tri-State meeting will be a special reduced registration fee ($3.00 per person) for those who wish to attend educational sessions only and cannot stay for the evening festivities. The regular registration fee ($9.50 per person) includes everything—educational sessions, banquet and dance. Tickets for the Tri-State Meeting may be obtained from Richard K. Evans, Bill Young & Co., Inc., 1843 N. Reading Road, Cincinnati 15, Ohio.


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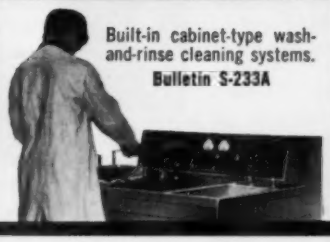

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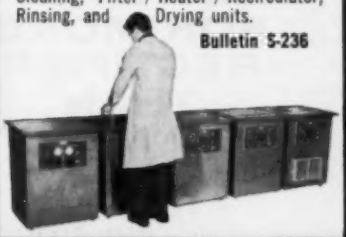

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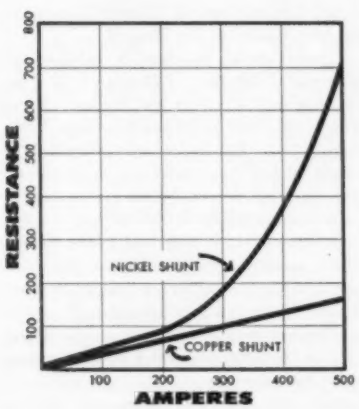


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**E. Marcum,** E. I. DuPont Co., Inc. gave a very interesting speech concerning the Leveled-Copper Plating Process. A short history on the development of the cyanide copper plating process from the cold bath to the present hot high speed copper plating bath was given. Details were then presented on the DuPont leveled-copper plating process stressing the high leveling properties of the bath when used in conjunction with periodic reverse current and interrupted current. Following the talk members inspected parts which were level copper plated and also sample which were bright nickel and chrome plated over the leveled copper. The surface of the leveled copper plated samples were very bright and no buffing was required between the copper and bright nickel plate.

**Elmer Schuster**
*Secretary*

## HARTFORD

### Bergin Explains Buffing Techniques

The regular branch meeting was held at the Veterans of Foreign Wars building in Elmwood on Jan. 18 and because of a snow and sleet storm only 28 members and guests dared the weather. Preceding the meeting a colored movie entitled "Sky Holiday" was shown.

The guest speaker for the evening was **Frank Bergin** of the Lea Manufacturing Co. whose subject was "New Techniques in Buffing".

Mr. Bergin confined his talk to the use of liquid buffing compounds and stated that for their use the following are needed: a spray gun, tank, timing device, pump and a properly engineered air and piping system to bring to each spray the same amount of properly atomized compound.

It was pointed out by the speaker that the buffs last longer because the water in the compound keeps them cooler, money is saved on compound because its use can be controlled better, no left over pieces as in bar use and no down time for changing over compounds. The number of rejects are lowered because the compound is easier to wash off. These materials are especially good for automatic and semi-automatic machines.

The technical chairman for the evening was **Ruel Katz.**

**Stanley Platoz**
*Secretary*

## INDIANAPOLIS

### Beckwith Speaks on Duplex Nickel Plating

The year 1960 started off for the Indianapolis Branch with a good attendance at the Jan. 5 meeting when 52 were present for the dinner and four more for the meeting. Our president, **Les Reynolds,** presided and asked for introductions. At this meeting a member was present who was a founder and first president of the Indianapolis Branch. He was Walter Binai. A hardy round of applause was extended to him.

**L. J. Howald** of the Cincinnati Branch reported on the Tri-State meeting to be held April 23 at Cincinnati. There will be morning and afternoon educational sessions with a variety of topics to appeal to management, shop personnel and others. The ladies are to be entertained by a fine program.

Our president told us about the new application for membership blanks and showed them to each member. He had a part in designing this new form since he is national membership chairman.

Under new business, nine new members were voted into the Society in a motion by **Ed Bruck** and seconded by **Quentin Shockley.**

The third sustaining member was announced by our president. It is Guide Lamp, Division of General Motors of Anderson.

A letter was read by the secretary introducing **Robert Girard** of the Springfield Branch as candidate for third vice president of the National Society.

**Mark Trook,** librarian, introduced the speaker of the evening. He was **Dr. M. M. Beckwith** of Harshaw Chemical Co., one of our own members. The topic was "Studies of Duplex Nickel Plating". Dr. Beckwith gave the background of nickel finishing and testing especially for the last ten years. Many interesting facts were told and slides were shown to show just how the tests are made.

**Edna Rohrabaugh**
*Secretary*

## MILWAUKEE

### Swift Talks on Finishing

The 504th meeting on Jan. 8 was called to order by President **Cy Taterczynski.**

One application for membership was approved.

**Herman Tessman** reported on the last meeting of the G.M.T.C. After describing in detail, what had been accomplished at this meeting, he suggested that a committee be formed to study both by-laws and constitutions and report to the board of managers who in turn would be able to instruct the delegates. He stated that he could see no real purpose in an affiliation at this time.

**Les Diveley** reported that a Council meeting would be held on Jan. 30 at the Conrad Hilton Hotel in Chicago. At this meeting an election of officers would be on the agenda. He stated that, it was important we follow this election closely, as it was possible future national officers could come from this group.

The members were asked by **Gene Piellusch** to contact a member of the membership committee when they have a prospect. A meeting was to be held in the very near future on methods of acquiring new members.

The educational sessions on the Branch and Annual level were discussed and the suggestions were carried over to the board of managers to act upon.

**Curt Hunsaker** introduced **John Swift** of the Swift Chemical Co. who presented a paper, with film and slides on "What the Finisher Should Know."

**Frederick F. Padgett**
*Secretary*

### MONTREAL
### Mazzamaro on Brass and Bronze Plating

The regular monthly meeting of the Montreal Branch was held on Dec. 14, 1959 at the Sheraton-Mount Royal Hotel. It was called to order by president **R. Takeuchi.**

**Jim Saimoto,** our librarian, introduced **Pat Mazzamaro** of True Brite Chemical Co., Oakville, Conn., speaker for the evening. Pat gave a very interesting and enlightening talk on Brass and Bronze Plating. After answering numerous questions Pat was thanked on behalf of the Branch by **Tony Copeland.**

The Branch accepted two more new members into its fold.

**R. W. Niggemann**
*Secretary*

### MONTREAL
### Ben Presents Illustrated Talk on Chrome Plating

The Montreal Branch got its first meeting of the New Year off to a wonderful start. The evening of Jan. 12 began with an executive meeting held at 7:15 p.m. at the Sheraton Mount Royal Hotel, followed by our regular monthly meeting at 8:30. The meeting was called to order by our President **R. Takeuchi** with 29 members present.

Librarian **J. Saimoto** then introduced **Manuel Ben** of General Motors Research Laboratories, Detroit, Mich. Mr. Ben gave a very interesting and enlightening talk and showed some excellent slides on Functional Chrome Plating. He was thanked on behalf of the Branch by **J. Rennie.**

**R. W. Niggemann**
*Secretary*

### NEWARK
### Diggin Branch Honorary Member; McMullen and Blount Present Papers

At the Dec. 11, 1959 business meeting of Newark Branch six new members were elected.

Two resignations were approved and two suspensions authorized. **Don Foulke** moved that **Myron Diggin** be nominated as Honorary Member of the Branch; **George Wagner** seconded, and the approval was unanimous. The Secretary was instructed to send to **Al Howe** (retiring from General Electric Company) the best wishes of the Branch.

Librarian **Al Korbelak** introduced **Warren McMullen** of Hanson-Van Winkle-Munning Co., who discussed "Electrode Potentials of Plated Coatings." He stated that the electrode potential of bright nickel (measured vs. pure nickel, or a reference electrode) was more anodic than a semi-bright or Watts nickel. He then showed how the less noble bright nickel sacrificed itself in the duplex system. With a number of slides, Warren showed how pitting developed under accelerated test conditions as predicted by the electrode potential measurements which he had made.

**Ezra Blount** then discussed various methods of applying organic coatings including the newer developments in coating methods such as electrostatic spraying, airless spraying and flow coating.

On the following night, Dec. 12, over 350 members and guests of the Newark Branch assembled at the Robert Treat Hotel for the 46th Annual Banquet. The affair was most pleasantly initiated by a cocktail hour sponsored by MFSA members Enthone, Inc., Frederick Gumm Chemical Co., Inc., Hanson-Van Winkle-Munning Co., Metal and Thermit Corp., Sel-Rex Corp. and The Udylite Corporation. This was followed by an excellent roast beef dinner and a fine floor show; then dancing.

**D. Gardner Foulke**
*Secretary*

### NEW YORK
### Yacus Discusses Barrel Finishing

The Jan. 8 meeting was called to order by first Vice President **Jack Weiner.**

A new member was sworn in by Mr. Weiner.

Banquet committee informed that an excellent menu has been approved and first class entertainment has been signed up for Feb. 6.


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So as to expedite review and other processing, please write the Editor, PLATING, 445 Broad Street, Newark 2, New Jersey, for full particulars before submitting your manuscript.

**George Herrmann** asked for cooperation in securing gifts, to make this Ladies Program a bigger success than last year's affair. There will be a card party and beautiful prizes will be awarded.

**Martin Pollack** reports that an excellent Technical Session is arranged.

**Milton Nadel** informed that the MFSA will offer a cocktail party for their friends at 5:00 p.m. in the Penn Top of the hotel.

**Martin Pollack** introduced **Steve Yacus** of the Abrasive Machine and Supply Co. Mr. Yacus subject "New Methods in Barrel Finishing" was very well presented. He covered the operation of various types of barrels, including the latest vibrating units. By the use of the proper media and compounds superfluous stock can be removed at a much faster and cheaper rate than by conventional methods. He described several types of barrels on the market and shop-made adaptations similar to a paint can shaker used to provide the motive force in a vibrator unit. He also covered other units being developed for speedier and better results.

**Fred Saras**
*Recording Secretary*

### PHILADELPHIA
### Morris, Walters and Trusdell Panel Speakers

The regular meeting was held on Dec. 16 at the Engineers' Club with 34 at dinner and about 55 at the meeting. Guests were introduced; one active member was admitted; the minutes of the previous meeting were read; the treasurer's report was given by the secretary, in the absence of the treasurer; bills to be paid were read by the secretary. The proposal of the Engineers' Club offering other meeting arrangements to the Branch at reduced cost was accepted.

Librarian Berenato presented the speakers, a panel of platers from the Branch, this feature now an annual event. The first was **Raymond Morris,** Fox Products Co., whose topic was "Plating of Die Castings." Mr. Morris discussed all phases of die cast plating and included casting, polishing, plating and rework in his talk. The second was **Edward Walters,** Walters Plating Company, who spoke about "Barrel Copper Plating." Mr. Walters talked about tank construction, anode positioning, cleaning, solution composition and operating conditions, with particular mention of the high free cyanide content necessary to maintain anode corrosion (3 oz/gal optimum). He recommended a slurry of materials regularly added for maintaining the composition.

The third panelist was **William H. Trusdell,** Platers & Coaters, Inc., his subject: "Zinc Plating". Following a brief resume of the basic differences between the three methods of application: galvanizing, acid zinc and cyanide zinc plating, Mr. Trusdell described the practices observed in operating a large, fully automatic, cyanide zinc plating machine used for plating wire wear. He stated that optimum carbonate content was within the range of 4 to 6 oz/gal; above 10 oz/gal produced coarse grained deposits.

The general feeling of those present was that this type of meeting was of such value to platers, it should be held more frequently than once a year.

**I. Wm. Marcovitch**
*Secretary*

### PHILADELPHIA
### Carroll Discusses Acid Inhibitors

The regular meeting was held on January 25 at the Engineers' Club with about 50 attending. Branch President **Cogan** opened the meeting by stating this was the first meeting of the Branch 50th anniversary year. He passed among those present the Tribute from the City of Philadelphia received by the Branch in honor of this event. Following introduction of guests by First Vice President **Hoffmann,** Librarian **Berenato** introduced the speaker, **James W. Carroll,** Pennsalt Chemicals Corp., Research Laboratories, whose topic was "Inhibited Acids in Electroplating Cycle."

Mr. Carroll gave the following advantages for the use of inhibitors in acids: a) saving of metal; b) saving of acid; c) less hydrogen absorption reducing danger of hydrogen embrittlement; d) less attack on the metal giving better appearance; e) reduction of smut; f) reduction of operator's errors due to overpickling part damage; g) flexibility of cycle time and temperature. He showed slides illustrating the effects of


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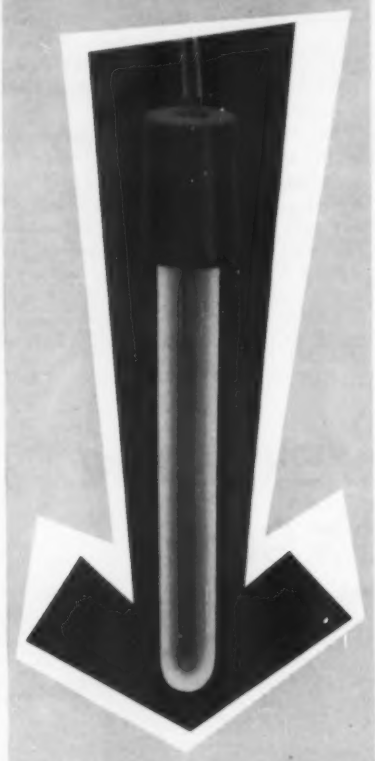

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inhibitors on plate adhesion; effect of various degrees of rinsing following inhibited acid dips; effect of inhibitor carryover into the plating solution; effect of inhibitor film on nickel brighteners. He also gave several plating cycles where inhibited acids were used.

The minutes of previous meeting were read; the treasurer's report was given. Reports of the 50th Anniversary Committees' progress were given. Five membership applications were received; bills approved for payment were read.

**I. Wm. Marcovitch**
*Secretary*

## PHOENIX

### Gustafson Talks on Water Treatment: Far West Regional Discussed

Our meeting was held Tuesday, Jan. 12, at our new permanent meeting place, The Armed Services Officers Club, 3334 East Camelback, Phoenix.

After the usual social hour, the members enjoyed a roast beef dinner and the business meeting started at 8:00 p.m.

The secretary reported on his assignment as delegate to the First Southwest Aero Space Symposium held in Ft. Worth Dec. 7–9, 1959. We were invited to join with other southwest Branches in forming a Southwestern Regional and our members indicated that we should, because of the great distances, first check with Los Angeles, Denver, San Diego and San Francisco on possible formation of a Far West Regional. **Ralph Alexander,** Cannon Electric Co., a member of the Los Angeles Branch volunteered to discuss this with his Branch and report to us.

Members were asked to indicate if they plan on attending the Los Angeles Convention. A good attendance from our Branch is expected.

**William Griff,** president, read the by-laws and with one minor change, they were approved.

Two new members were approved. One resignation was accepted.

**Paul Wible,** librarian, introduced our speaker, **H. B. Gustafson,** chief chemist, Infilco, Inc. Mr. Gustafson spoke on Water Treatment. Lenthy discussion complimented Mr. Gustafson on his informative talk.

Guests introduced were: **Ralph Alexander,** Cannon Electric Co.; **Seymour Thomas,** Cortez Chemical Co.; **A. L. Frick,** Infilco Inc.; **Dario Travaini,** City of Phoenix Water Dept.; and **Gregg Bujewski,** Motorola. Twenty four members and guests were present.

**James Weaver**
*Secretary*

## SAGINAW VALLEY

### Ternstedt-Flint Plant Tour

The annual plant tour meeting was held on Wednesday, Jan 13. Attendance was 115 members and guests. Our AES Branch extends its thanks to the management of the Ternstedt-Flint Division of General Motors Corporation for a very informative tour and an excellent dinner.

**Harrison F. Hooker**
*Recording Secretary*

## ST. LOUIS

### Viola Discusses Rectifiers

The regular monthly meeting was held Jan. 13 at the York Hotel with 23 members and guests present for dinner. There were 30 members and guests present when the business meeting was called to order by President **William Piel.** Everyone stood and introduced himself and gave his company affiliation.

An announcement was made of the Dixie Regional meeting and of the Chicago educational session and banquet. A letter was read from **Rafael Diaz,** chairman, Speakers List, AES educational committee requesting names of new speakers that were not listed in the 1959 speakers list.

A letter from the Springfield Branch asking that our delegates support **Robert Girard** for the office of National Third Vice-President was presented.

A letter from Headquarters was read relative to increasing membership with men 1) having a serious personal interest in electroplating, metal finishing and allied arts, 2) having a thirst for educational enrichment in the arts and sciences of that field, 3) having deep desire to join and become lastingly assimilated by an AES Branch and, 4) having the character and personality to "fit" and "belong in such a Branch.

A letter was received from **Robert M. Norton,** chairman, public Relations Committee, relative to more appealing and attractive monthly educational sessions . . . to publicize them even more effectively . . . to draw larger attendance.

A letter from **Palmer H. Langdon,** publisher, *Metal Finishing,* called our attention to a special train from Chicago to Los Angeles and asked if it would be of interest.

The delegates were reminded that they were to select a member whose deeds warrant consideration for the Charles Henry Proctor Memorial Leadership Award, and **Andy Julius** reported that the exposition site would not be decided until the Interim meeting.

Librarian **Richard Gotsch** introduced the speaker of the evening **James A. Viola,** president and electrical engineer of Rapid Electric Co. His talk was on Selenium, Germanium and Silicon Rectification in the Plating Industry and Related Controls. The talk was illustrated by blackboard diagrams. Much interest was created and a very active question and answer period followed. The meeting was adjourned with a rising vote of thanks to Mr. Viola for his interesting talk.

**Ward Kelly**
*Secretary*

## SPRINGFIELD

### Waste Disposal Presented by Civan

The Springfield Branch met at Blake's Restaurant on Jan. 25 for the regular monthly meeting. President **Elery C. Gibson** spoke a few words of welcome to **Armand Faucher,** president of Hartford Branch, who spent the evening with us.

A new member was accepted.

Chairman of the Activities Committee, **Wayne B. Sanders,** gave a progress report on the coming Turkey Shoot planned for the end of March.

As the business part of the meeting was concluded, the meeting was turned over to Technical Chairman **Harold Mitchell.** Mr. Mitchell introduced the speaker **C. Civan,** manager of the Metal Finishing Division of the George L. Nankervis Company of Detroit, Michigan. His subject is of prime interest and importance today, in many other fields besides the metal finishing. Mr. Civan spoke on Waste Disposal, and explained what was happening to the water supplies because of indiscriminate dumping of wastes, and what pollution does to the sportsman, boating and other water activities. He told of the various methods of combatting these conditions, with the emphasis on the neutralizing of chromic acid wastes and the cyanides.

The subject was enlightening and educational, as evidenced by larger than normal turnout of members for this meeting. It was a request subject, and the ones who benefitted the most were the ones who attended the meeting and asked the questions on the particular phases of the problems that interested that particular phases of the problems that interested that individual. Altogether, it was a good meeting, with a good subject, by a good speaker, at a good time.

**Henry L. Heissfeld**
*Secretary*

## TORONTO

### Patrick Speaks on Chromate Coatings

The Toronto Branch held its regular monthly dinner meeting Jan. 8 in the Algonquin Room of the Royal York Hotel.

The meeting was called to order by **Gord Lince,** who acted on behalf of **Ray Day,** our president. At the time, Ray was in the hospital recovering from an operation.

After the business session, **Reg Irwin** introduced our speaker, **J. D. Patrick,** production development department, MacDermid Corp., who gave a very interesting talk on the dyeing of chromate coatings, a new trend in color coatings. **Art Wilson** thanked the speaker on behalf of the branch.

Reg Irwin won the $5.00 dinner prize and **Mel Platt** the draw prize.

There were 20 present for the dinner and 38 for the meeting.

**G. A. Lince**
*Executive Vice President*

## WATERBURY

### Foulke Speaks on AES Research

The Waterbury Branch had its annual Sustaining Members Night on Jan. 14, at the Hotel Roger Smith. Representatives of ten of the Branches Sustaining Members and two prospective Sustaining Members were present.

A short business meeting was held before the introduction of the speaker. Two new members received membership certificates. **Jim Kennedy** reported that the first book had been donated to the Branch for presentation to the local library as part of our program to furnish the local library with a complete collection of technical books related to metal finishing.

The Waterbury Branch's Valentine Party will be held at the Waterbury Country Club on Feb. 6. It is billed as a stupendous event.

**Ray Mitchell,** technical chairman, introduced the speaker **Dr. D. Gardner Foulke** who spoke on "The AES Research Program." Dr. Foulke described the program from its inception, outlining the major projects and contributions of the program. He gave those present an up-to-date report on current projects and explained to the Sustaining Members present just how their contributions were being spent and the value they were getting for their dollar.

The next technical session will be held at the Roger Smith Hotel on Thursday, March 10.

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## DETROIT

### Christmas Party "Big Night of Year"

The Nov. 6 meeting was preceded by dinner at "Victor Lims" and, of course, we all had a very enjoyable time for, as you know, that is the time we get to have a real gab fest.

The meeting itself was short and down to regular business as we wanted as much time as possible for Mrs. Helen Bierbower to show us how to decorate Christmas cakes and cookies, it was very interesting and some of it very intricate.

We did not have a December meeting as the next night was the big night of the


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We wonder how Herb Head liked getting his tie cut into bits and having it put back together again. If you find out how it is done, Herb, please let us know then we can all have fun.

Sure nice our out-of-town member, Marge Pinner, could be there, and did you all see Howard McAleer with his beard—which he grew while hunting in Montana—but you know, Howard, on you it looks good.

Now to get back to PLATING MAGAZINE. Really, John, we did not know we had such talent. The editorials keep getting better and better. We do wish everyone would read them. November PLATING had a wonderful one by Herb Head called "Do It Now". We wonder if we couldn't reprint the verse.

"If with pleasure you are viewing, any work a man is doing,

"If you like him or you love him, tell him now.

"Don't withhold your approbation, till the parson makes oration, as he lies with snowy lilies on his brow.

"For no matter how you shout it, he won't really care about it, he won't know how many teardrops you have shed.

"If you think that praise is due him, nows the time to slip it to him, for he cannot read his tombstone when he's dead."

How true this is, how many of us mean to do something today but never seem to get around to it. So be sure to read PLATING today and every month. It gets more interesting every issue.

Remember if you read PLATING, you know.

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## AMERICAN ELECTROPLATERS' SOCIETY

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| March 26, | 1960—**Phoenix Branch,** Arizona Metal Finishing Symposium and Industrial Exhibition, Arizona State University, Paul Wible, General Chairman, 3622 East Sheridan, Phoenix, Ariz. |
| April 8-9, | 1960—**Executive Board Meeting,** National Headquarters, Newark, N. J. |
| April 9, | 1960—**Baltimore-Washington Branch,** Annual Banquet and Dance, Presentation of the "Order of the Pot," Park Plaza Hotel, Baltimore, Maryland. |
| April 22, | 1960—**Editorial Board Meeting,** Sheraton-Gibson Hotel, Cincinnati, Ohio. |
| April 23, | 1960—**Sixth Tri-State Regional Meeting,** Cincinnati Host Branch, Sheraton-Gibson Hotel, Cincinnati, Ohio. |
| April 23, | 1960—**Twenty-First Annual New England Regional Meeting,** Bridgeport Host Branch, Hotel Statler, Hartford, Conn. |
| April 29-30, | 1960—**Sixth Empire State Regional,** Southern Tier Host Branch, Mark Twain Hotel, Elmira, N. Y. |
| April 30, | 1960—**Milwaukee Branch,** Annual Meeting and Banquet, Schroeder Hotel, Milwaukee, Wis. |
| May 6, | 1960—**Buffalo Branch Annual Meeting,** Niagara Manor, Buffalo, N. Y. |
| May 7, | 1960—**St. Louis Branch,** Annual Spring Banquet, Ambassador Hotel, St. Louis, Missouri. |
| July 24-28, | 1960—**47th AES Annual Convention,** Hotel Statler, Los Angeles, Calif. |
| July 24, | 1960—**Executive Board Meeting,** Statler Hotel, Los Angeles, California. |
| September 17, | 1960—**Boston Branch 24th Annual Educational Meeting and Banquet,** Hotel Statler, Boston, Mass. |
| February 3-4, | 1961—**Third Annual Dixie Regional Technical Session,** Hotel Roanoke, Roanoke, Virginia. Blue Ridge Host Branch. |
| June 18-23, | 1961—**48th AES Annual Convention,** Hotel Statler, Boston, Mass. |
| June 25-28, | 1962—**49th AES Annual Convention,** Schroeder Hotel, Milwaukee, Wis. Sponsorship Midwest Regional Council. |
| June 24-27, | 1963—**50th AES Annual Convention,** Ambassador Hotel, Atlantic City. N. J. Sponsorship Newark Branch. |
| June 21-25, | 1964—**51st AES Annual Convention,** St. Louis, Missouri. |
| July, | 1965—**52nd AES Annual Convention,** Statler Hotel, New York, N. Y. |

# FUTURE MEETINGS

## INTERSOCIETY

**April 7-8, 1960**—**American Zinc Institute,** 42nd Annual Meeting, Chase-Park Plaza Hotels, St. Louis, Mo.

**April 20, 1960**—**Society of Plastic Engineers,** North Texas Section, Regional Technical Conference, Hotel Texas, Fort Worth, Texas.

**April 21-28, 1960**—**American Society of Tool Engineers,** Tool Show, Detroit Artillery Armory, Detroit, Michigan.

**May 1-5, 1960**—**The Electrochemical Society,** Spring Meeting, LaSalle Hotel, Chicago, Ill.

**May 3-5, 1960**—**15th Purdue Industrial Waste Conference,** Purdue Memorial Union Building, Purdue University, Lafayette, Indiana.

**May 9-13, 1960**—**American Society for Metals,** 2nd Southwestern Metal Exposition and Congress, State Fair Park, Automobile Building, Dallas, Texas.

**May 14, 1960**—**Masters' Electro-Plating Association,** 42nd Annual Banquet, The Plaza, New York, N. Y.

**June 26-July 1, 1960**—**American Society for Testing Materials,** 63rd Annual Meeting (with Apparatus Exhibit), Chalfonte-Haddon Hall, Atlantic City, N. J.

**July 22-24, 1960**—**National Association of Metal Finishers,** 5th Annual Convention, Hotel Statler, Los Angeles, California.

**July 24, 1960**—**Metal Finishing Suppliers' Association,** Board of Trustees Meeting, Hotel Statler, Los Angeles, Calif.

**July 25, 1960**—**Metal Finishing Suppliers' Association,** Annual Luncheon and Meeting, Hotel Statler, Los Angeles, Calif.

**September 7-15, 1960**—**2nd Coliseum Machinery Show,** Chicago Coliseum, Chicago, Ill.

**October 9-13, 1960**—**The Electrochemical Society,** Fall Meeting, Shamrock Hotel, Houston, Texas.

**October 17-21, 1960**—**American Society for Metals,** 42nd National Metal Exposition and Congress, Trade and Convention Center, Philadelphia, Pa.

**November 8-11, 1960**—**Society of Die Casting Engineers,** First National Die Casting Exposition and Congress, Detroit Artillery Armory, Detroit, Mich.


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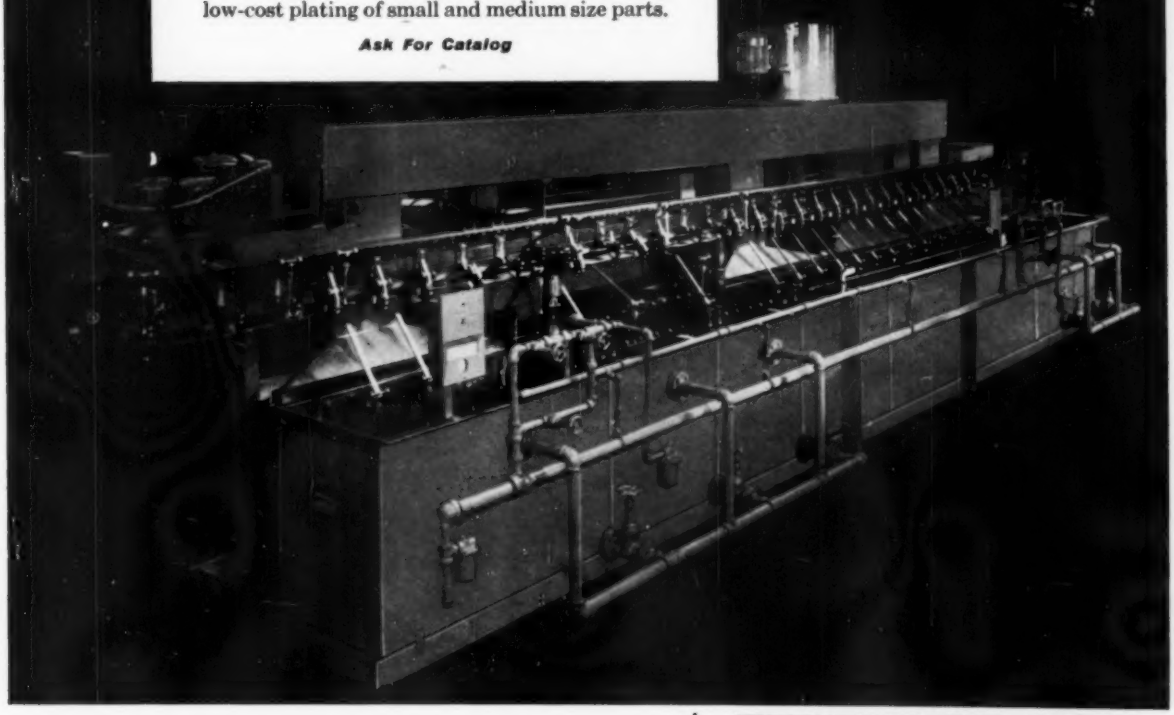

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